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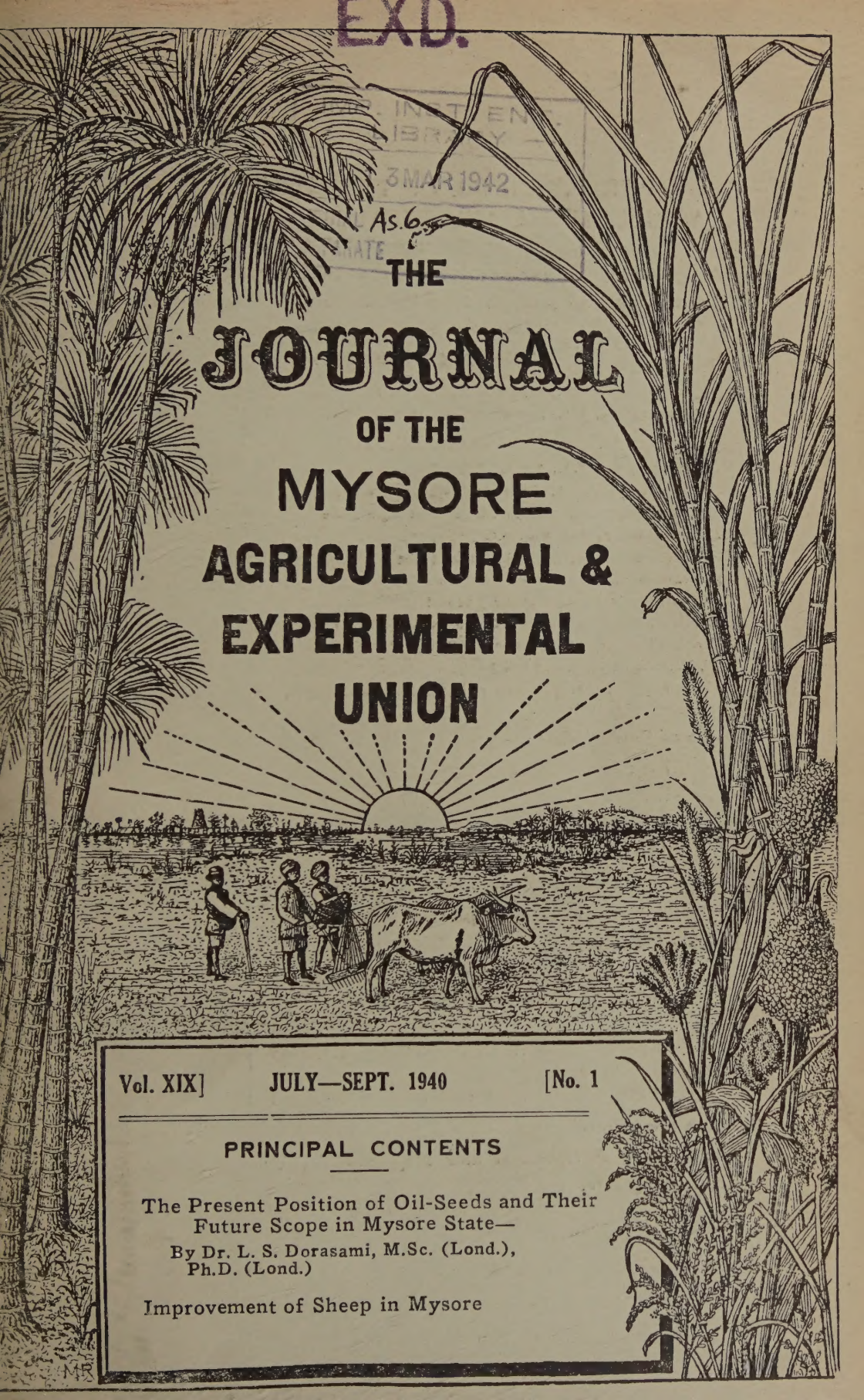

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PRINCIPAL CONTENTS

The Present Position of Oil-Seeds and Their Future Scope in Mysore State—
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Improvement of Sheep in Mysore

The Late Maharaja of Mysore

H. H. MAHARAJA SIR SRI KRISHNARAJA WADIYAR BAHADUR, G.C.S.I., G.B.E.

whose benevolent rule of 38 years was one of continued progress in the field of Agriculture as well as in that of Industry in Mysore.

He passed away on the 3rd of August 1940

AGRICULTURE IN MYSORE
1899–1940

1899–1910 *Beginnings—*

1899 Agricultural Chemist is appointed. This marks the beginning of the Agricultural Department.

1904 The first Experimental Farm is started at Hebbal near Bangalore.

1905 A Civil Veterinary Officer is appointed. Beginning of Civil Veterinary Department.

Department of Co-operative Societies is constituted.

1906 The first Veterinary Hospital is opened at Bangalore.

1908 The Horticultural Department is organised on its present lines.

A Mycologist and Entomologist is appointed.

1910–20 *Foundations—*

1913 The Mysore Agricultural School, Hebbal, is started.

1914 The Agricultural Department is organised on its present lines.

A Botanist is appointed. Beginning of Plant-Breeding Work on Mysore crops.

Marthur Farm is started near Sagar in Shimoga District. Study of *Malnad* crops.

Sericultural work is started afresh.

1915 An Agricultural Engineer is appointed.

1916 An Experimental Farm is started at Babbur near Hiriyur in Chitaldrug District for the cotton and jola tract.

A Kannada Agricultural School, **Sree Krishna Rajendra** Vyavasaya Dharma Pathasala, is started at Chikkanahally, near Sira in Tumkur District. Beginning of Kannada Agricultural Schools.

1917 Nagenhally Farm is started near Mysore. Paddy-Breeding Station (1928).

1918 An Agricultural and Experimental Union is started.

1920–30 *Projects: Cauvery Reservoir,* **Krishnaraja Sagara**—*Irwin Canal—Soil Survey. Royal Commission—*

1920 A Live-stock Station is started.
Civil Veterinary Department is amalgamated with the Agricultural Department.

1923 A Sheep-Breeders' Association is organised at Kolar.

1924 His Highness opens the deliberations of the Board of Agriculture in India at its sessions in Bangalore.

1925 A Coffee Experiment Station is started at Balehonnur in Kadur District.
A Sheep Farm is started at Yelachihally near Mysore.

1927 The Mysore Serum Institute is started.

1928 Kar Ragi Breeding Station is opened at Hunsur (1928–39).
Agriculture is introduced as a subject of study in Rural Middle Schools.

1929 A Cattle Breeding Station is started at Ajjampur in Kadur District.
A Kannada Agricultural School is started at Ramakrishnapur in the Anekal Taluk, Bangalore District.

1930–40: *Phenomenal developments in Sugar and Tobacco. Bee-Keeping and Poultry-Keeping extended. Co-operative research with the Imperial Council of Agricultural Research, India. Research carried to the doors of the raiyats —*

1931 His Highness opens the Coffee Laboratory at the Balehonnur Farm.
The Irwin Canal Farm is started near Mandya.
A Kannada Agricultural School is started at Hassan (1931–38).

1935 A Sugarcane-borer Parasite Laboratory is established at Mandya.

1938 A Sheep-Breeders' Association is started at Mysore.
A Cattle-Breeding Station is started at Hunsur. Government pass orders to organise seed farms and demonstration plots in raiyats' fields.

1939 Government pass orders to open Subvention Farms for experimental purposes on the raiyats' own holdings.
A Kannada Agricultural School is started at Somanahally near Maddur.

1940 A Sheep-Breeders' Association is started at Closepet, Bangalore District.
An Agricultural Colony is started near Maddur in the Irwin Canal area.

His Highness
SRI JAYA CHAMARAJA WADIYAR BAHADUR
Installed on the Throne of Mysore on 8th September 1940

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The Present Position of Oil-Seeds and Their Future Scope in Mysore State

By

Dr. L. S. Dorasami, M.Sc. (Lond.), Ph.D. (Lond.)
Economic Botanist, Department of Agriculture
Mysore State

The total area under oil-seeds in Mysore State is nearly 712,471 acres. Sixty-seven per cent. of this area under oil-seeds lie in the Districts of Chitaldrug, Tumkur and Mysore. Hassan, Kolar, Shimoga, Bangalore and Kadur account for the rest. The important oil-seeds grown are groundnut, cocoanut, castor, gingelly and cotton. The area under groundnut is the largest—214,669 acres. Next in importance is cocoanut which accounts for 174,389 acres. Castor occupies an area of 99,373 acres. Gingelly is grown in an area of 85,357 acres and cotton seed in 84,666 acres. Chitaldrug, Kolar and Tumkur Districts produce most of the groundnuts. Cocoanut is grown chiefly in Tumkur, Hassan, Mysore, Kadur and Chitaldrug Districts. Castor is found in cultivation in large areas of Chitaldrug, Tumkur and Mysore Districts. Gingelly is primarily cultivated in Mysore District and large tracts of cotton are found in Chitaldrug District.

During the last ten years the area under cocoanut has steadily increased and the acreage under groundnut and castor has decreased by 34% and 7% respectively. The decrease has been attributed to the low and unremunerative prices and to the varieties of oil-seeds used which give poor yield, for want of proper manuring and attention to other cultural operations and timely rains. Except those ryots who preserve some seeds for their sowings during next season, the rest depend for their seed supply on the local *dallal* or middleman, who may or may not be in a position to supply genuine seeds capable of giving maximum percentage of germination and vigorous plants. The dependence of the ryot for seeds on local *dallal* is also a cause for gradual decline in the acreage under oil-seeds. The importation of oil-seeds at a cheaper rate from outside and re-exporting it is also one of the causes for this decrease in the acreage. The ryot is at a disadvantage if he cannot secure a reasonable cost for all his troubles on account of the transactions of the *dallal* who imports oil at a cheaper rate. The difficulties encountered by the ryot are manifold. He is indebted to the *dallal* who finances him. At the expense of the ryot, he makes a profit at every transaction. In the first instance the *dallal* loans money at a certain interest (6–7%) for purchase of oil-seeds; then he gets a good commission (2–3%) when he sells the ryot's produce. When the yield is poor or the crop is a failure and the *dallal* is not able to recover the initial loan given for purchase of seeds, etc., he charges further exhorbitant interest (12–13%) and tries to recover the money later. In consequence, the ryot is under an obligation to the *dallal* from whose clutches he never seems to free himself. Thus, with his indebtedness, with his indifference to adopt scientific methods of cultivation, the decline in the acreage under oil-seeds or the quantity of oil-seeds produced at a reasonable cost is not surprising.

As envisaged in 'Agricultural Problems in Mysore', the "financing of agriculture and organisation of marketing are no less important factors in increasing production ...". More number of organisations like that of Maradihally

Co-operative Society which has "shown the higher income earned by growers by combination in marketing their produce and avoiding the profits of the series of middlemen" are necessary. Such organisation in large numbers prevent "middlemen setting up competition among producers and reducing the margin of profit to the producer". Co-operative organisation for oil-seed production and marketing is one of the most important factors to increase production, the earning capacity of the ryot and thus to lessen his indebtedness.

There is a very great demand for groundnut and castor oil-seeds. Castor seeds are exported from India to the extent of Rs. 64 lakhs, the value of export of groundnut oil-seeds varies from Rs. 600–900 lakhs per annum and the export of groundnut oil-cake comes nearly to Rs. 100 lakhs per annum. Most of this is exported from Bombay and Madras Presidencies. Coconuts grown in Mysore State are in great demand in North India. It is learnt that there is not enough material to meet the demand. There is thus a great scope for improving the oil-seed production in Mysore with a view not only to increase the agricultural prosperity of the State but also by capturing the export trade to a greater extent than at present.

With a view to introducing high yielding strains which are more remunerative, this Department has been evolving new varieties in all the important oil-seeds to suit the different localities.

Castor.—Recently several promising strains of castor obtained from Chickmagalur were under trial at Babbur Farm. As most of these selections have compactly packed spikes varying from 1½ to 2 ft., they are being multiplied. The oil-content of these strains varies from 47.1% to 52.99%. As these strains are very promising and are heavy yielders (500–800 lbs. per acre) and as castor tolerates the poorest soils involving the least cost of cultivation and as there is scope for expansion of cultivation in red and black soil, the question of extension of castor cultivation is being pushed through. The recent experiments carried out on inter-cropping shows that castor tolerates inter-cropping

with any dry crop—ragi, horsegram, togari and chillies. Inter-cropping with leguminous crops, not only improves the land under cultivation but also ensures better production of crops during the succeeding seasons. Thus with the advent of the inter-cropping and introduction of better strains of castor, there is every chance of increasing the earning capacity of the ryot by increase in the production of oil-seeds and other grains. As already indicated increase in the production or yield of castor will enable us to contribute a greater share of this commodity in the export trade.

Groundnut.—It is the most important commercial crop which brings in money to the State. It improves the soil and affords a cheap nutritious food for man and cattle. It is found superior to soya beans in its vitamin content and is now advocated in preference to soya beans in dietary. Extension of groundnut cultivation which should be encouraged need not cause anxiety about the production of other food grains. It is found that there is an increase of ragi by about 30% when ragi is rotated with groundnut. It can be grown as an inter-cropping plant either with cotton or ragi. Varieties to suit different conditions of soil and climate have been collected and tested. Several improved varieties have been evolved. These are under statistical trial at Hebbal, Babbur and Irwin Canal Farms. Several hybrids which combine the desirable qualities of both the bunch and spreading varieties are also under trial. Promising selections from these will be tried statistically after which, the best will be released for general cultivation.

Cotton.—The State is not producing enough cotton to meet the local demand of the mills and population. It has to produce nearly one crore of rupees worth of more cotton. Propaganda is being conducted to increase the yield by 50%, particularly in the black-cotton soil area by adopting new methods as "(1) reduction of the space between cotton rows; (2) planting of erect plants instead of bushy ones so as to have more number of plants; (3) increasing the number of bolls of higher ginning percentage and their size by the introduction of new varieties which have been evolved and tested".

It is found that the scope for producing more of M.A.II, Doddahatti cotton in either irrigated or dry condition in red loamy soils is unlimited. As an irrigated cotton, M.A.II grows exceedingly well throughout the area in the Irwin Canal Tract. As a dry crop it can be inter-cropped with ragi. By the spread of this variety in non-black-cotton soil areas and by judicious manuring and attention to cultural operations it is hoped to increase the yield of cotton in Mysore considerably and thus stop importation in Mysore but also create a surplus in course of time.

With the increased production of cotton there will also be a check in the importation of cotton seeds. But what is urgently needed at present is to have more power gins in the cotton-growing areas. For want of power gins all the cotton produced is ginned outside and the cotton seed imported on a large scale, for expressing the oil.

Cocoanuts.—There is an increase in the acreage under cultivation. Copra produced in Tiptur Taluk, commands a very good market. But there is a good deal of variation in size, shape, colour, etc. This Department has taken up the work of raising several thousand improved seedlings of cocoanuts. Selected nuts have been gathered from important cocoanut growing areas, and these have been planted. A large number of seedlings raised from selected palms are being distributed.

Gingelly.—The area under gingelly is 85,352 acres. There is sufficient scope for increasing the area under this. Even the small amount, 12,000 railway maunds, imported annually, may be stopped. Black gingelly is the main type cultivated. It is proposed to have a collection of all the local varieties and to select a type which will give a higher yield.

Linseed.—The area under linseed is practically very little and the quantity imported is 5,000 railway maunds. Several varieties of linseed have now been collected from Bombay, United Provinces, Bengal, Pusa and from different localities in the State. It is found that linseed has given very good yield as a cold weather crop at Irwin Canal Farm.

Experiments are now being conducted to ascertain the best season or optimum condition for growing of linseed at Irwin Canal Farm. If the growing of linseed is found successful in the Irwin Canal area, the quantity of oil-seed necessary for internal consumption can easily be met with. After expressing linseed oil which is used for varnishing and other purposes, the cake can be advantageously used as a feed for milching cows. The plants after the seeds are harvested, can be retted and fibre extracted from the stalks. The crude fibre can easily be made into strong ropes, etc., as in the United Provinces. The retted stalks of linseed are also used in paper manufacture. The production of fibre can easily be started as a cottage industry.

In conclusion, to increase the agricultural prosperity of the State, attempts are being made to increase the area under oil-seeds by distributing improved varieties of oil-seeds, along with paddy, togari and sugarcane. Trial plots are being laid out to demonstrate the fact that the dry farming which is now only a mere wage-earning in kind could be raised into a "lucrative calling with a margin of profit by extensive inter-cropping".

Subvention Farm, Nilsoge, T.-Narsipur Taluk Mysore District

By

N. Viraraja Urs

Land-holder, Nilsoge

[The results of experiments conducted on a certain Government Farm with an improved type of seed evolved there, may not always be confirmed when it is tested in a new locality far from the Farm. The Paddy Breeding Station, the Irwin Canal Farm and the Babbur Farm have evolved a large number of strains of seed considered to be improved ones, but whether these yield high and are suited to the locality will be known only after local tests. To achieve this object, in a way, convincing as well as economic, the co-operation of leading raiyats have been sought and obtained, for laying out Subvention Farms. The raiyat himself experiments with a large number of improved strains and finds out which one suits his field or locality.

In the following article, Mr. Viraraja Urs, one of our co-operators, gives the results of his experiment with a large number of cotton varieties.—Editor.]

A subvention farm has been laid out since two years in my holding at Nilsoge. This is a new idea introduced among us by the Director of Agriculture in Mysore and the plot, I can say without exaggeration, a miniature experimental farm conducted at the very doors of the farmers without any extra cost. The idea if pursued by discerning landholders in as many places in the State as possible would easily help the raiyats to see good crops in their localities and afford them a reliable source of good seed supply.

During the year 1938–39, I laid out a plot with twelve varieties of cotton on an area of 2½ acres in order to choose out of them, a variety best suited to my locality.

The Officers of the Agricultural Department have constantly visited my fields throughout the period of growth of the above crop and we have benefited much by their valuable suggestions. When the previous Assistant Director of Agriculture in this District, Mr. S. V. Sharma, proposed to me to have a subvention farm in my holding, I was of opinion that this was a scheme quite foreign to us and much beyond our capacity. It is now a pleasure to state that I yielded to his persuasion and I have had a smooth experience with the test plots.

The results obtained with a few varieties of cotton on my subvention farm are tabled here:

Sl. No.	Name of variety	Area in guntas	Date of sowing	Yield April to May 1940	Yield June to August 1940	Total	Average yield per acre	
				lb.	lb.	lb.	mds.	lb.
1	Gaurani ..	7½	7-10-39	45½	50	95½	19	15
2	Nandyal ..	6½	,,	65½	52	117½	27	21
3	Nadam-like ..	,,	,,	37½	54	91½	21	17
4	S. 19 ..	,,	,,	19½	36	55½	13	3
5	K. 1 ..	,,	,,	45	53	98	23	5
6	C. 7 ..	,,	,,	62½	58	120½	28	7
7	1027 A.L.F.—Surat ..	,,	,,	3	30½	34	8	1
8	1027 A.L.F.—Baroda ..	,,	,,	4	34½	38½	9	3
9	Late Verum ..	,,	,,	29	64	93	22	0
10	Local Nadam ..	,,	,,	49½	42	91½	21	17
11	Jayavant ..	,,	,,	62½	62	124½	29	12
12	H. 190 ..	,,	,,	40¾	75	115¾	27	10
		2 acres	,,	523¼	756	1,279¼	21	0

The raiyats of my village have really wondered at the growth made by the cottons and have indented for the supply of reliable seeds of the Jayavant, C. 7, Nandyal and H. 190 varieties. These varieties have a much better performance

to their credit compared with others. Indeed it was felt to be a mystery, the knowledge of which was reserved by the Agricultural Department. I tested 213 varieties of *jola,* about which I shall report later on.

Just as cotton and jola have been tried here, I feel the same idea can be extended to all other crops of the State, sugarcane, paddy, ragi and groundnut, to quote a few. In enlisting the co-operation of the landholders in this form, the Agricultural Department, I may repeat, has shown us a really good means to benefit by its advice.

Trial of K. 1 Ragi in the Districts

By

M. J. Narasimhan, B.A.

Deputy Director of Agriculture in Mysore

It does not appear to be appropriate to recommend to the raiyats to grow a particular good variety of ragi all over the 22 lakhs of acres of ragi fields in the State, as the soil and climatic conditions are so varying, and as the sowing season in some areas is different from that in others. So much stress is laid on the type of ragi, suited for the season that raiyats in *hain* areas refuse to take up a *kar* ragi. However, the improved variety of ragi, K. 1, selected by the Department and introduced to raiyats' fields since the last two years has shown itself by its good yield to suit varying conditions, except perhaps in areas where growing ragi is out of question.

Numerous trials with this ragi were conducted on demonstration plots in raiyats' holdings all over the State, with the result that we have on hand a wealth of data relating to the yield on these plots. Not less valuable is the bundle of letters of appreciation by the raiyats. Some of the outstanding figures of yield are given below district*wise*:—

District	Taluk	Village	Grain in seers	Comparative yield of local ragi, if available
1	2	3	4	5
Bangalore ..	Bangalore	Kengeri	1,066	..
	,,	Varthur	1,280	600
	,,	Madivala	1.280	1,053
	Closepet	Byrapatna	800	..
	Kankanahalli	Aralasandra	800	..
	Devanhalli	Vadigenhally	1,971	1,723
	,,	Channarayapatna	1,920	864
	,,	Avati	1,300	..
	,,	,,	1,333	..

District	Taluk	Village	Grain in seers	Comparative yield of local ragi if available
1	2	3	4	5
	Devanhalli	Kundana	1,350	..
	Hoskote	Hoskote	1,306	840
	,,	Hindignal	1,080	400
	,,	,,	1,000	800
	,,	Sulibele	933	800
	,,	Hoskote	1,280	..
	,,	Sulibele	1,260	..
	,,	,,	1,200	..
Mandya ..	Maddur	Doddarasanakere	1,400	..
	,,	Vaidyanathapur	820	..
	,,	,,	800	..
	,,	,,	950	..
	,,	Hoskere	900	..
	Krishnarajpet	Gaddehosur	840	..
Mysore ..	Mysore	Kolagula	820	620
Hassan ..	Arakalgud	Basavapatna	800	320
Shimoga ..	Channagiri	Govinkovi	800	400
	,,	Lingadahalli	1,000	400
Chitaldrug ..	Jagalur	Jagalur	900	600
	Challakere	Reddihalli	933	640
	,,	Kondalhalli	1,666	1,333
Tumkur ..	Koratagere	Koratagere	773	..
	,,	Pakeerayyanapalya	1,040	..
	Madhugiri	Doddahosalli	1,000	800
Kolar ..	Chintamani	Kurubur	1,066	1,040
	,,	Kagathi	742	640
Average of yields for which comparisons are available ..			1,139	771

An analysis of the figures according to dates of sowing would be interesting.

Village	Sown on	Harvested on	No. of days	Yield in seers per acre
	(Sown before the end of April)			
Kengeri	28—1—39	29—5—39	121	1,066
Varthur	8—4—39	20—8—39	134	1.280
Byrapatna	27—3—39	17—8—39	143	800
Aralsandra	30—1—39	16—6—39	137	800
Vadigenhally	March 39	7—8—39	..	1.971
Channarayapatna	,,	11—8—39	..	1,920
Doddarasanakere	15—4—39	11—9—39	149	1,400
Hosakere	10—3—39	12—7—39	124	900
Gaddehosur	14—3—39	22—7—39	130	840
Kurubur	..	11—8—39	..	1,066
Madivala	17—1—38	7—6—38	141	1,280
Avati	23—3—38	9—7—38	108	1,300
,, ...	25—2—38	3—7—38	128	1.333
		Average ..	131	
	(Sown later)			
Hoskote	25—6—39	7-10—39	104	1,306
Hindignal	4—7—39	25-10—39	114	1,080
,, ...	20—7—39	28-10—39	100	1,000
Sulibele	23—6—39	7-10—39	106	933
Koratagere	27—6—39	25-10—39	120	733
Pakeerayyanapalya	21—5—39	25—9—39	127	1.040
Kagathi	..	15—9—39	..	742
Kundana	6—6—38	2-10—38	118	1,350
Hoskote	30—5—39	28—9—39	121	1,280
Sulibele	23—5—38	20—9—38	120	1,260
,, ...	20—6—38	18-11—38	151	1.200
Basavapatna	29—5—38	20—9—38	114	800
Govinkovi	18—6—38	19-10—38	123	800
Lingadahalli	15—7—38	4-11—38	112	1,000
Reddihalli	..	October 38	..	933
Doddahosahalli	8—7—38	15-11—38	130	1,000
Kondlahalli	20—7—38	October 38	..	1,666
		Average ..	118	

The duration is thus 131 days ranging between 108 and 149 in the case of the summer crop and 118 days ranging between 100 and 151 days in the case of the monsoon crop.

The above figures indicate the time taken by the crop from the date of sowing to the date of harvest. In the case of a crop that is transplanted, the time taken from the date of transplanting to the date of harvest is actually the more important point, as in the nursery stage the crop

occupies a very small space and besides being taken care of without much trouble can also be adjusted to suit one's time of cropping. From this point of view the time taken between sowing in the nursery and transplantation also comes into consideration as indicating the proper age of seedlings to be transplanted. These facts are brought out in the following table.

Village	Date of sowing	Date of transplanting	Age of seedling in days	Date of harvest	From transplanting to harvest in days	Acreage yield in seers
		(Sown before close of April)				
Varthur ..	8—4—39	4—5—39	26	20—8—39	108	1,280
Byrapatna ..	27—3—39	8—5—39	42	17—8—39	101	800
Madivala ..	17—1—38	28—2—38	42	7—6—38	99	1,280
Avati	..	6—4—38	..	9—7—38	94	1,300
,, ...	25—2—38	24—3—38	30	3—7—38	101	1,333
Vadigenballi ..	..	24—4—39	..	7—8—39	105	1,971
Channarayapatna	..	15—4—39	...	11—8—39	118	1,920
Kurubur ..	..	20—5—39	..	11—9—39	114	1,066
		(Sown later)				
Koratagere ..	27—6—39	27—7—39	30	25—10—39	90	733
Pakeerayyanpalya	21—5—39	29—6—39	30	25—9—39	97	1,040
				Average ..	100	

Generally seedlings of 1 to 1½ months of age are transplanted and the duration from the date of transplanting is on an average about 100 days ranging between 90 and 118.

In brief, K. 1 Ragi seems to have done well in various parts of the State, being grown both in summer and in monsoon and under irrigation. It takes about 4 months to come to harvest. Nursery may be raised and seedlings a month old can be transplanted. The crop matures in 3 to 3½ months after transplantation. On an average it has proved to be 50% better than the local ragi.

Cashewnut Cultivation in South Kanara*

By

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The cultivation of money crops in an agricultural holding is a necessity. For it is with the money thus realised that the cultivator is able to purchase necessities of life other than those produced on his farm. These commercial crops require not only the most fertile land but also much money as well as care for their successful cultivation. There are a few exceptions to this and cashewnut is very prominent among them. It thrives well where few other crops grow. Once a plantation is started it requires little care by way of cultivation, manuring, etc. Investment on a cashewnut plantation rarely ever fails to pay a sound dividend.

Cashewnut is believed to be a native of S. America, and introduced into India by the Portuguese; now it has become thoroughly acclimatised in this country and is growing in a very large area, mostly in Peninsular India.

Cashewnut is a tropical evergreen plant growing to a height of 30–40 feet depending on the fertility of the soil. It grows even in poor soil and is one of the drought-resisting plants. There are several types of trees having variations in the bearing, colour and size of the fruit, shape and weight of the nut, whiteness and hardness of the kernel, etc.. The cashewnut tree has practically three seasons of flush in the year. The first vegetative flush appears in the summer following the fruiting season. A second but a moderate flush appears in the month of July when there is heavy rain. The third one is in November and in a month's time the flower panicles appear. The fruits are formed in the summer and nuts are gathered from February to May.

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*Forwarded by the Principal, Mysore Agricultural School, Hebbal, with his letter No. 154 dated 31-8-'40, for publication in the *Journal*.

Cultivation.—The tree grows under various soil and climatic conditions. Though systematic cultivation and manuring are not given in some places of South Kanara, the tree has been found to respond to such treatments. The plant grows best on light sandy soils and laterite hill slopes in S. Kanara which receive 120–50 inches of rainfall during S.W. Monsoon. It also grows on the Madras coast which has a rainfall of about 35 inches. The Konkan farmers believe that the tree has got some exhaustive effect on soil and no plants grow in its neighbourhood. It is on account of this belief only hill slopes and waste lands are used for its cultivation.

Sowing.—Selection of seed nuts is an important part in raising a good cashewnut plantation. Generally medium-sized cashewnuts are chosen and sown *in situ* during S.W. Monsoon in pits of 1′ × 1′ × 1′ size. The distance between each pit is about 20 to 25 feet.

Basket Planting.—During recent years some well-to-do landholders of South Kanara who have started cashewnut planting are following a different method. Small baskets made up of Jack leaves are filled with earth mixed with manure, in the beginning of May and two or three seed nuts are sown in each of them. A sand-bed, six inches deep, is made near a well or a water source, and these baskets are kept on it and watered once in two days. Pits of the dimensions mentioned, *viz.*, 1′ × 1′ × 1′, are dug in selected places and filled with manure beforehand and after the monsoon has set in the seedlings with the baskets are transplanted into these. For first two years fencing is necessary for protecting the young plants from the ravages of cowboys and cattle. The trees begin to bear after three years and continue up to fifteen to twenty years. Thereafter they exude a gummy substance which indicates the peak of the bearing period. There onwards a persistent decrease in yield is noticed. In S. Kanara the trees are found in flowers from December to February. The succulent fruit which is formed by thickening of pedicel, develops and is ready for

harvest in 2 to 2½ months. The trees bear best in a year of a long and hot summer.

The fruits with the apple are plucked in February, March and April. A long bamboo with a hook at the tip is used for this purpose. Good yields are obtained from the seventh or the eighth year. The yield varies from 15 to 40 lb. per tree.

Pest and Diseases.—In S. Kanara the only disease attacking the cashewnut tree is "Die-back". Sometimes this disease causes great loss by the complete death of whole trees. The disease can be kept in check by timely pruning of affected branches and applying tar to the cut portions. The burning of diseased branches is the only effective remedy to check the spread of the disease. No insect pests have been found in S. Kanara.

The total expenses in cashewnut plantation are negligible. Apart from the money invested in purchasing the land, the other expenditure connected with it comes to Rs. 10 to 15 per acre till the tree begins to yield. For the first five years a tree bears on an average 15 lb. of nuts and after that 25 lb. of nuts may be expected. In addition 100 to 150 lb. of apples are obtained from a tree. Number of nuts per pound varies from 60 to 150. In the local markets of S. Kanara, nuts are sold at 9 pies per pound. Raiyats sell this to the middleman. Sometimes he sells the apples at 1 anna per hundred. A net income of Rs. 70 to 90 may be obtained from an acre of good plantation. In S. Kanara tender nuts are in great demand where they fetch good price of 2 annas per 100. This is usually sold by the *Harijans.*

Curing.—In the villages of S. Kanara District the nuts are roasted in a broken earthen pot and then shelled. This is a cottage industry in Karkal, Bantwal, Puttur and surrounding villages. There are big factories at Mangalore, engaged in curing the cashewnuts and they buy nuts at the rate of about Rs. 3–8–0 per *Mura* of 42 Madras seers. Two of the several factories are managed by Europeans. The process of curing involves several operations like roasting, shelling, peeling, sweating, grading and packing.

Roasting.—The nuts are uniformly dried and roasted in open iron pans, 3′ × 2′ in size, over mud furnaces, stirring all the time so as to roast uniformly. Sometimes water is sprinkled to prevent shells from getting charred. Usually the shell itself is used for fuel in roasting. The roasted nuts are spread on the floor and some ash is sprinkled to dry the oil on the nuts, as it is caustic and blisters the skin. Two men can roast about 6,500 lb. of nuts in a day of six hours. While roasting certain amount of oil is obtained and this costs about one anna per bottle.

Shelling.—Shelling is done by hand with the help of small wooden pieces or stones to break the shell. This is done generally by women on contract system at 4 pies per pound of kernels obtained. Each woman can shell about 15–20 lb. per day. The kernels obtained by shelling will be 25 to 30% of the whole nuts and out of these kernels 75 to 89% will be whole and 11 to 25% will be broken.

Peeling.—After shelling, the kernels are either sun-dried or dried over a furnace in wire-gauze trays at 70° C. and the outer skin is removed. Some amount of moisture is lost during the process of curing. This is also done by women coolies at 4 pies per pound of whole and 2 pies per pound of broken nuts.

Sweating.—Water is sprinkled slightly over kernels after peeling to prevent splitting and breaking.

Grading.—In markets, there are four classes of kernels (1) good big kernels, (2) good small ones, (3) broken ones and (4) rejected and spoiled. Grading is also done by women and one woman can sort 55 to 70 lb. of kernels per day and earn 4 to 5 annas per day.

Packing.—The kernels are packed in tins containing 25 lb. each. The tins are vacuumised and some carbon dioxide is allowed inside which is found to be the best method to stand storage for a period of about 8 to 10 months. Kernels are sold in local markets at 4 to 5 annas per pound of "Wholes" and 2 to 3 annas per pound of "Brokens".

Uses.—Cashewnut is a familiar article in every Indian household. It is largely used in foreign countries, especially

in U.S.A. Some years back cashewnut cultivation was neglected in India, but now it is slowly improving. Indian cashewnut captured the foreign market after the War of 1914–18.

The cultivation of cashewnut gives a good return at a minimum cost. Every part of the tree is useful to man and its by-products are popular in the market.

Tree.—Tree as a whole is used for firewood. Charcoal is prepared from the wood. It is believed the gum that exudes from the bark has a good insecticidal property and is also used in tanning.

Nut.—In Europe cashewnut kernel is used in making confectioneries. In S. Kanara, the kernels from tender nuts are used for curry, *payasam*, etc. Kernels form a common ingredient of many varieties of cakes and sweetmeats. The thin pinkish seed coat together with the small pieces of kernels forms a good feed for poultry.

Oil is extracted from the shell. The reddish brown oil has a great demand in the market. The shell contains about 29% of oil but only 10% to 15% is extracted. The oil is used in preparing varnishes, insulating coatings, etc. This is largely used on the West Coast by fishermen for their boats and nets as the oil is a good preservative and prevents the termite attack. Some native doctors use this against some form of leprosy and other skin diseases. This is used with kerosene in certain proportion (about 1 : 19) to kill the larvæ of mosquitoes.

Cashew Apple.—This is a swollen pedicel. It is succulent and contains about 1 to 2 ozs. of juice. People like it for its sweet juice. The yellow apples are big in size and contain large quantities of juice which is sweeter than that of red ones. The juice is fermented to prepare toddy. It is used by native doctors in some medicines. The apple forms a good feed for pigs.

Though S. Kanara is the largest of the cashewnut-growing centres of India, the industry there has not progressed properly. So the factories at Mangalore are importing nuts from Africa. Otherwise, the factories have to be

closed for 4 months in the year and more than 15,000 poor people have to struggle for their bread.

It is learnt from a Government communique that the Madras Government have approved a scheme of planting cashewnut trees in unreserved forests of the S. Kanara District and sanctioned necessary staff. This shows Government are fully alive to the importance of cashewnut cultivation. In Mysore also the Department of Agriculture, Forests and Horticulture are taking keen interest to introduce cashewnuts in the available waste lands.

Groundnut Varieties and Seasons

Groundnut besides being grown in new localities is also taking an important part in field practices, such as growing it as an intercrop with cotton, in rotation with ragi and as a catch-crop after paddy. It is necessary from this point of view to know the seasons of cultivation and duration of growth of different varieties. Information collected by the Botanical Section of the Department on these points is given below by districts and in summary.

Groundnut

(By Districts)

District	Range	Variety	Sowing	Harvesting	Remarks
1. Mandya ..	Mandya	Spanish	March–April June–August	July–August December–Januray	Two seasons for sowing
	Maddur	do.	January	April–May	Popular in Irwin Canal area
		Small Japan	July	October–November	Grown on dry lands as rain-fed crop
	Krishnarajapet	Spanish and H.G.I.	August–September	December–January	
	French Rocks	do.			Groundnut is not grown on large scale. Recently these varieties are being distributed
	Irwin Canal Farm	do.	3½–4 months		Planting done at all seasons
		Sogatur	5 months		
2. Hassan ..	Hassan	Small Japan Spanish	May–June	September–October	
	Arsikere	do.	April–May	August–September	
	Holenarasipur	do.	February–March	July–August	As a special crop under tank achkats
			May–June March	September–October June–July	As a summar crop in channel area

GROUNDNUT—*Contd.*

(By Districts)

District	Range	Variety	Sowing	Harvesting	Remarks
3. Bangalore ..	Bangalore	Small Japan	May beginning	August end	
	Doddaballapur	Local spreading	June–July	November–December	
	Anekal	do.	May–July	September–November	
	Channapatna	do. Spanish and H.G.I.	June	October	
	Devanahalli	Badami kai (spreading)	May–June	October–November	
		Local spreading	June–July	November–December	
	Hebbal Farm	Sogatur spreading	do.	December–January	5–5½ months
		Mauritius	do.	do.	
		H.G.I. erect	do.	do.	5 months
		Spanish erect	July	October–November	3½–4½ months
		Small Japan erect	do.	do.	do.
		Valencia erect	do.	do.	3½–4 months
4. Shimoga ..	Channagiri-Honnali	Spanish	June–July	do.	
	Shimoga	Local spreading	do.	do.	
	Shikaripur	Spanish	do.	do.	
5. Tumkur ..	Kunigal	H.G.I.	May–July	September–October	
		Spanish	do.	August–September	
		Mauritius	June–July	November–December	
			February–March	July–August	
	Tumkur	Small Japan	August	December	

	Tiptur	Local and Spanish H.G.I.	May–June do.	September–October do.	Newly introduced
	Madhugiri	Mauritius	June–July	November–December	
	Sira	Spanish and Mauritius	do.	End of November–December	
6. Mysore ..	Mysore	Mauritius	May	October	
	Hunsur	Local spreading	do.	do.	Not grown on large scale
	Nanjangud	do.	do.	do.	do.
	Krishnarajanagar	Sogatur and Valencia	June	November	
7. Chitaldrug ..	Babbur	Spanish	May	October–November	No information available for other ranges
8. Kadur ..	..	..	..	..	Negligible area
9. Kolar ..	Kolar	Mauritius or akin to it (spreading)	July–August	November–December	
		Spanish	do.	do.	Being introduced

GROUNDNUT

(*Summary*)

Variety	Period of Maturity	Remarks
Spanish	3½–4½ months	Very popular. Grown in all the Distrcits. It is an early variety. Crop harvested after 4 months; yields good pods
Valencia	do.	An early variety. Not grown on a large scale anywhere
Small Japan ..	do.	An early variety. Grown in parts of Mandya, Hassan, Bangalore and Tumkur Districts
H.G.I.	5 months	Popular and grown in all most all the Districts
Mauritius	5–5½ months	Late variety. Popular in Kolar District. Grown also in some parts of Mysore and Tumkur Districts
Sogatur	do.	Not appreciably cultivated. It is a late variety
Local spreading ..	do.	It is grown along with the improved Spanish and H.G.I. everywhere. The local spreading is grown under different names in different parts

Groundnut is mainly grown as a rain-fed (dry) crop. It is also grown as an irrigated crop under tank achkats, channel areas and as a subsidiary crop after irrigated ragi or paddy. It is usually planted, depending on the seasonal conditions and practices prevalent in the several areas, from March to July. At Irwin Canal Farm experiments are being tried to grow them throughout the year. The yield of groundnut on the average is 8–10 pallas per acre.

Rations for Cattle in Mysore

(Contributed by the Live-Stock Section)

Albuminoid ratio to lie between 1:2 and 1:4.

1. *Cow in milk up to 750 lbs. live weight*:—

For maintenance 5 lbs. S.E. } For 10 lbs. milk 2¼ lbs. S.E. }			7¼ lbs.	S.E.
Fodder 30 to 40 lbs. per day.				
Concentrates 4 to 6 lbs mixture.				
Groundnut cake	3 lbs.	S.E. 2.22 @ 74	D.P. 1.23 @ 41	
Rice Bran	2 „	0.92 @ 46	0.12 @ 6	
Horsegram	1 „	0.66 @ 66	0.19 @ 19	
Mixture	6 lbs.	3.8 lbs.	1.54 lbs.	

Gram husk, about 1 lb. per day may be given as an appetizer.
Albuminoid ratio 1.54 : 3.8 = 2.4.
30 lbs. to 40 lbs. hay or silage and grazing will give
7.25 — 3.8 = 3.45 lbs. S.E.

(*a*) Dry cow will receive only maintenance ratio of fodder and 3 lbs. mixture for needs of developing calf in womb.

2. *Bull up to 800 lbs. live weight*:—

Maintenance 5 lbs. S.E. } Energy 5 „ „ }			10 lbs.	S.E.
Groundnut cake	3 lbs.	= S.E. 2.22	and D.P.	1.23
Rice Bran	2 „	= „ 0.92	„	0.12
Horsegram	3 „	= „ 1.98	„	0.57
	8 lbs.	5.12 lbs.		1.92 lbs.

Albuminoid ratio 1:2.6.
6 lbs. mixture give 3.84 lbs. S.E.
40 to 60 lbs. fodder with grazing will give
10 — 3.84 = 6.16 lbs. S.E.

3. *Weaned calf up to 250 lbs. live weight*:—

Maintenance 2.4 lbs. } Growth 2.75 „ }			5.15 lbs.	S.E.
Groundnut cake	3 lbs.	= S.E. 2.22	and D.P.	1.23
Rice Bran	2 „	= „ 0.92	„	0.12
Horsegram	2 „	= „ 1.32	„	0.38
	7 lbs.	4.46 lbs.		1.73 lbs.

Albuminoid ratio 1.73 : 4.46 = 4.46 = 1:2.6.
4 lbs. of mixture will give 2.55 lbs. S.E.
20 lbs. to 30 lbs. fodder with grazing will give
5.15 — 2.55 = 2.6 lbs. S.E.

4. *Bullocks up to* 1,000 *lbs. live weight*:—

Maintenance	6 lbs.	}		12 lbs.	S.E.
Work	6 „	}			
Groundnut cake	3 lbs.	= S.E.	2.22	and D.P.	1.23
Rice Bran	3 „	= „	1.38	„	0.18
Horsegram	3 „	= „	1.98	„	0.57
	9 lbs.		5.58 lbs.		1.98 lbs.

Albuminoid ratio 1.98 : 5.58 = 1 : 2.8.

50 lbs. to 60 lbs. fodder with grazing will give

12 — 5.58 = 6.42 lbs. S.E.

6 lbs. to 9 lbs. mixture may be given as concentrated rations.

N.B.—Salt should be given to all stock at the rate of 2% of concentrates.

Bone-meal may be given in a sterilized form at the rate of 1% of concentrates in localities where want of lime is suspected in the soil.

Improvement of Sheep in Mysore

Sheep-Breeders' Association, Kolar

The annual report of the Kolar Sheep Breeders' Association for the year 1939–40 reveals an year of progress for the organisation and its statement of the present condition of the Sheep Industry in general and attempts that are being made to improve it are interesting. The following account is based upon the report.

Sheep Raising as it is.—Sheep raising in Mysore State which is inseparable from Agriculture has been carried on for ages with the main object of producing manure and selling the surplus stock. Sheep folding is a time-honoured method of recouping the fertility of the soil. It is not unusual to leave the flocks in charge of boys of eight to ten years of age and club two or more of these while grazing or folding for manure.

Handicap to Controlled Breeding.—Under these conditions a controlled breeding of the animals cannot be practised, and the offsprings, desirable or otherwise, have to be taken for what they are worth. They go to increase the flock and the process of culling out the coloured sheep and forming uniform flocks turns out to be rather tedious.

Wool Neglected.—A continuance of these defects of management is largely due to the fact that sheep-rearers do not consider wool as a main item of revenue. They feel contented with a return of one '*Kambli*' costing about Rs. 2 to Rs. 3 for a wool crop of 100 sheep sold away to the local wool dealers. Consequently the wool-bearing qualities of the animals are not given much consideration and a head of sheep yields just 12 oz. to 1 lb. of wool.

An Estimate.—Even at this rate it would be interesting to see the return that sheep can yield in the one district of Kolar. According to the live-stock census there are 472,722 sheep in the District. Two-thirds of the total

number on the average may be taken to yield an income of Rs. 2 per head as detailed below:—

	Rs.	A.	P.
Wool, 12 oz. costing ..	0	3	0
One lamb for every 2 years @ Rs. 3 each	1	8	0
By value of manure produced ..	0	5	0
TOTAL ..	2	0	0

The total amount that would be realised would come to nearly 6¼ lakhs of rupees. With an improvement in the quantity and quality of wool it seems quite possible to increase this 3- to 4-fold which would easily meet the entire land revenue of the District.

Government Experiments.—Experiments conducted by the Government in cross-breeding our country-breeds with Merinos, have proved that the progenies bear not only superior quality of wool but also yield 2 to 3 times more in quantity than the local animals. Latterly flocks of pure white sheep have been formed among the local breeds themselves. In either way the sheep-rearers stand to gain by adopting the methods indicated by the results demonstrated by the Government.

The Association.—The Kolar Sheep-Breeders' Association was started in the year 1922 with a strength of 16 members on the roll. To-day the strength of the members is 312. Its Committee of Management consists of a President, a Vice-President and six other members elected from the General Body, and the Sheep Expert, District Veterinary and Live-Stock Officer, and a Secretary, the last three being officers of the Agricultural Department and *ex-officio* members of the Committee. Besides the subscriptions from the members, the funds of the Association are reinforced by subventions from the Kolar District Board as well as the Government.

Sheep under the Control of the Association.—The strength of sheep under the control of the Association increased from 10,000 in 1937–38 and 15,000 in 1938–39 to 15,700 in 1939–40. Of these 15,700, 1,500 are Merino-

country cross-bred, 5,500 are country pure white and the rest coloured. It is stated that some of the members lost a fairly good number of sheep in their flocks from the parasitic diseases and there were outbreaks of Anthrax, parasitic diarrhœa and liver fluke in Malur, Bowringpet, Goribidanur and Chintamani Taluks. Among the factors that averted greater losses may be mentioned timely *mungar* rains affording sufficient grazing throughout the year and timely medical aid arranged to combat the diseases.

Demand for Hybrid Rams.—The demand for hybrid rams has increased in proportion to the realisation of the advantages by the members. Eighty-one rams were distributed in 1938–39 and 74 in 1939–40 in the Kolar District. Many of the rams so distributed were from the improved flocks of the members themselves and this purchase has at once encouraged the members as well as facilitated the work of the Association. Some of the members are asking for pure Merinos also to head their flocks.

Castration.—Particular attention has been bestowed on the castration of undesirable rams in the flocks of the members. During the year under report 560 rams were castrated. It is stated that the methods of sheep-rearing and clubbing together of the flocks belonging to the members with those of others are in the way of reaping as much benefit from this practice as is possible. Centres of intensive work have therefore been chosen with a view to forming a few flocks of pure white sheep.

Dipping.—The practice of dipping sheep in Kymac lotion was continued as before and 5,384 sheep were dipped during the year. Facilities were given for the construction of sheep-dipping tanks to the members.

Shearing.—Machine shearing is becoming more and more popular. About 19,459 sheep were sheared in 1938–39 and 19,915 in 1939–40. Additional shearers were employed by the Association to meet the demands from members. Still there have been delays and it is pointed out that these can be avoided if Village Panchayats purchase shearing machines of their own.

Marketing of Wool.—Marketing of wool received from the members is conducted on a co-operative basis. During the year under report the rates of wool were fairly satisfactory. Almost all the mixed wool received from the members was purchased by the Association for the manufacture of woollen carpets for which there was a demand from the Kolar Gold Fields. About 6,526 lb. of wool was received from the members and 7,745 lb. of mixed wool was purchased from the local dealers to meet the requirements of the Association during the year.

Grading.—All along the Association has devoted considerable attention to grade the wool for purposes of sale. That it pays, may be seen from the statement showing the average price per lb. of different grades of wool as were procurable during the past three years.

	1937–38	1938–39	1939–40
	Rs. A. P.	Rs. A. P.	Rs. A. P.
Cross-bred wool ..	0 10 11	0 9 3	0 7 7
Country white wool ..	0 6 5	0 4 0	0 4 9
Mixed wool ..	0 3 2	0 2 7	0 3 4

Manufacture of Woollen Fabrics.—The Association manufactures woollen fabrics just as a demonstration. One improved framed shuttle loom at a cost of Rs. 68 was purchased and put into operation during the year. The fabrics consist of different kinds of high class shawls, *kamblis* and design carpets. Five hundred and eleven of these were manufactured as against 210 in the previous year and the Association has made Rs. 2,396–2–10 by the sale of these.

Conclusion.—Appreciations won for the samples of wool and woollen fabrics wherever exhibited indicate that the rural population engaged in sheep industry can derive much benefit by adopting the improvements indicated and working in associated groups such as the Kolar Sheep-Breeders' Association. Two associations have already been formed on these lines, one at Mysore, and one at the Rural Welfare Centre, Closepet, and this is indeed a sign of hope in the direction of improvement of sheep in Mysore.

What the Raiyats Say

Opinions from the raiyats who adopted a few departmental suggestions have already been published in two previous issues of this *Journal* and the *Mysore Agricultural Calendar* for 1939–40. In giving a few more opinions here it must be stated that the raiyats' say is indeed the final proof that a particular strain of crop or agricultural method is suitable for his locality. Some results gain their recognition in the accurate statistical tests of the experimental farms. These are again proved on the subvention farms, in the practically duplicate experiments conducted on a central private holding. The most successful of these results should show their superiority when tried alongside the local practices in the raiyats' own way. This is the idea underlying the arrangement of demonstration plots. A raiyat in giving out his true opinion about an improvement does a real good turn to his fellow farmers.

Ragi (*Elucine coracana*)

K. 1 *Ragi.*—

Mr. P. S. Shama Rao, Pothaganahalli, Hoskote Taluk, Bangalore District:—

"My brother, Mr. P. Rama Rao got a sample of K. 1 ragi which I sowed over an area of 10 guntas (40 guntas equals 1 acre). Harvested in proper time it yielded me 4 pallas of grain. The local *Yedegar* ragi for an equal area yielded me just 2½ pallas. This was in spite of the K. 1 ragi having suffered from heavy showers."

Mr. K. G. Putte Gowda, Katte Belaguli, Holenarsipur Taluk, Hassan District:—

"I raised a crop of ragi on 3 acres of land with the seed of K. 1 strain supplied by you according to the suggestion of the Department. I got from this area 18 pallas of grain and 73 bundles of straw. This works out to 6 pallas of grain and about 25 bundles of straw per acre, whereas the local strain of ragi has not yielded more than 5 pallas of grain per acre. I think we should adopt the K. 1."

E.C. 513.—

Mr. Paldar Gowdra Kariappa, Kumbalur, Harihar Sub-Taluk, Chitaldrug District:—

"I placed 1 acre of my land this time under E.C. 593 strain of ragi. This gave me 520 seers of grain. Local ragi grown by the side of this gave just 370 seers of grain per acre. The new strain yielded 2½ cartloads of straw, whereas the local yielded 1½ cartloads to the acre."

Mr. Gowdra Basappa, Malebennur, Harihar Sub-Taluk, Chitaldrug District:—

"I raised E.C. 593 strain of ragi on 7 acres of land and got 8½ pallas of grain and 2 cartloads of straw. The local ragi resulted in just 3½ pallas of grain and 1½ cartloads of straw to the acre."

H. 22 Ragi.—

Mr. B. S. Sadasivappa, Baggavalli Village, Ajjampur Hobli, Kadur District:—

"I got a quantity of H. 22 ragi seed from the Agricultural Department in 1938–39, the seedlings from which were transplanted over an area of 5 acres. The total yield secured by me was 40 pallas of grain and 20 cartloads of straw. The local ragi in the same circumstances has given 4½ pallas of grain and 3 cartloads of straw per acre. This indicates how much better is H. 22 than the local strain of this crop."

Paddy

Mr. K. G. Putte Gowda, Katte Belaguli, Holenarsipur Taluk, Hassan District:—

"I planted S. 661 paddy in an acre of land near Kenche village, cultivating the land according to Departmental instructions. The result was 16 pallas of grain and 36 bundles of straw to an acre. The yield of the local strain was observed to be 13 pallas of grain and 33 bundles of straw to an acre. This illustrates the advantage of the new seed."

Mr. Choode Gowda, Vastara, Chickmagalur Taluk, Kadur District:—

"Last season, I got a few samples of paddy from the Department. Grown side by side they yielded as follows:—

Area of the plot	Strain of paddy	Grain in seers	Straw in pounds
10 guntas	S. 661	350	750
Do	S. 194	300	600

"Compared with these, the local paddy yielded 2 pallas of grain and 450 lb. of straw in a plot of the same area."

Cotton and Spanish Groundnut

Mr. Gowda Shivappa, Kalapanahally, Davangere Taluk, Chitaldrug District:—

"Groundnut of the Spanish variety is commonly grown in the black cotton soils of this locality. Cotton is grown as a separate crop. I sowed my groundnut crop on 11-7-1939. Two months after this, I took the suggestion of the Agricultural Department and sowed H. 190 cotton with a spacing of 2 feet by 2 feet in the midst of the groundnut plants. This was tried on an extent of 10½ acres. The groundnut yielded 30 maunds of pods to an acre and cotton 12 maunds of lint with seed. I find this combination profitable."

Use of Fertilisers

For Paddy.—

Mr. Narasimha Murthyachar, Ramanathpur, Hassan District:—

"I tried the manures given by the Department on half an acre of paddy. The manured plot yielded 1,160 lb. of grain and the unmanured plot of the same area by the side yielded just 980 seers."

For Sugarcane.—

"I applied the fertilizers given to me by the Department to 4 guntas of sugarcane. The yield from this plot weighed 11,259 lb. I had a check plot of 2 guntas without this fertilizer, the yield of which weighed 2,238 lb. (just 4,476 lb. for 4 guntas). This experience has indicated to me the utility of applying fertilizers to the cane crop."

Napier Grass

Messrs. Brahmappa Thavanappa, Mysore:—

"Seedlings of Napier grass sufficient to plant 4½ guntas were supplied to us from the Jeevanrayana Katte Farm. These were planted in two different plots. One plot was irrigated once a week. Here the grass grew to a height of 5½ to 7 feet. The other plot was left to the rains. Here the grass grew from 5 to 6 feet. In this latter plot which was 1¾ guntas in extent, a crop of 1,350 lb. was obtained.

"This Napier grass seems to be a good fodder for the cattle, especially to the milking animals. It yields a quick cutting and does not seem to exact much attention."

Mr. Veerappa, Nagarle, Nanjangud Taluk, Mysore District:—

"I planted the Napier grass seedlings in an acre of rather saltish land. In spite of the bad condition of the land and want of water, the crop has come up well. It has grown 6 feet full, every hill having 20 to 25 tillers. Already two cuttings have been taken and fed to the cattle. They eat the grass with relish and seem to have improved in condition. The Department has done well in introducing this grass to the villages."

Mr. Bale Gowda, Bidaragere, Kunigal Taluk, Tumkur District:—

"I raised a nursery from 2 lb. of Napier grass seed and transplanted the seedlings as suggested by the Department. For one month after transplanting there was no rain. Still the seedlings struck root and grew to 5 feet height after the land was hoed. Cattle ate the grass with great relish. We can very well grow this grass in the *gomal* lands."

Mr. P. K. Putturajappa, Periyapatna, Mysore District:—

"I am thankful to the Agricultural Department for having supplied me with Napier grass seeds. I sowed them in the nursery on 8-5-1939 and the seedlings were ready to be transplanted on 22-6-1939. I manured both the nursery and the plots in which the seedlings were transplanted.

In the initial stages the plants had to face a drought. They recovered after the rain fell. Each hill has on average 50–60 tillers; 75 of them can be counted in places. The grass has grown 5 to 6 feet tall. When this fodder was placed before the cattle for the first time, they were not attracted to it. Latterly they have begun to eat it well. It seems to be a good fodder.

"Raiyats can easily grow this grass in lands otherwise left uncultivated and on the borders of the cultivated fields. After seeing the trial in my lands the neighbouring farmers are now inquisitive about it."

Mrs. Greenprince, Periyapatna:—

"The Napier grass seed given to me by the Department was sown in the nursery on 8-5-1939 and the seedlings were transplanted into the Field on 2-7-1939. The plants have now grown 4 to 5 feet tall. A cutting has been taken and cattle are seen to relish the fodder. Some of the cutting has been made into hay and preserved for the next summer."

Mr. H. C. Papanna, Dodballapur, Bangalore District:—

"I grew the Napier grass in a plot of my land. It made a good growth. One or two cuttings have been taken and fed to cattle. This grass would make a good crop for the uncultivated wastes. It stands drought and serves as a reserve of fodder. I am desirous of placing some more area of my lands under this."

Mr. Shada Gopalachar, Anekal, Bangalore District:—

"The sowing of the Napier grass seed given to me by the Department was made just as the rains commenced and the growth has been good standing about 4 feet high. About five seers of seeds also may be procured for further sowings. The grass seems to be a good fodder to the cattle."

Mr. N. S. Nanjundiah, son of Mr. Sreekantiah, Doddamudige village, Thippasandra Hobli, Magadi Taluk, Bangalore District:—

"I got Napier grass seedlings to cover 10 guntas of land and transplanted them in my land. The crop has grown 5 to 5½ feet high. As rains failed 20 days after transplanting, many seedlings dried away. The others were

watered and later recovered completely. Cattle eat this grass with relish."

Mr. Kadappa, Chennagiri, Shimoga District:—

"I have already taken a few cuttings from the Napier grass raised from the seeds given to me and tried feeding the stuff to a milking buffalo. It has eaten all the grass placed before it without leaving stalks and residue. My experience indicates its suitability as a fodder."

Mr. P. V. Subbaraya Shastri, of Bhadra Colony, Shimoga District:—

"It seems to me that Napier grass can be grown with advantage in all sorts of lands. It grows 5 to 6 feet tall. Grass is green even when earheads are formed. Cattle like this fodder very much. I found that when different grasses were placed before them they ate this with preference. I think growing this grass ought to have a place in our cattle management."

Mr. Naranayya, Chairman, Hosabale Village Panchayat, Sorab Taluk, Shimoga District:—

"Napier grass has grown 7 to 8 feet tall in my lands. It is just in earheads but the grass is still green. Cattle like this very much."

Messrs. Hosabale Subba Rao Brothers, Sorab Taluk:—

"Napier grass sown in our Hosabale lands have made a growth superior to any of the grasses grown there. Cattle eat this grass with relish and it may very well spread in the locality."

Mr. B. S. Madhava Rao, Koppa, Kadur District:—

"I raised a nursery from 1 lb. of Napier grass seed as suggested by the Agricultural Department. Fifty days' seedlings were transplanted in half an acre by the side of my areca garden. The plot was cultivated timely and in proper manner and in about 6 weeks the crop came up 5 to 6 feet high. Cattle were found to eat the grass very well. I consider this a good grass for our *malnads* and it will solve our fodder problems."

Mr. Rudrappa, Chairman, Bettadahalli Village Panchayat, Tarikere Taluk, Kadur District:—

"I had to raise the crop of Napier grass under difficulties as many seedlings died for want of rain. The survivals have given me satisfaction in as much as they have grown from 6 to 7 feet high.

"Raiyats here thought that cattle would not eat this grass. When fed actually it was a surprise that they did eat it with great relish. There seems to be no doubt that it is a good fodder. I am making some seed from the crop raised by me."

Mr. H. Seetharama Iyer, Bikkali Village, Hariharpur Hobli, Koppa Taluk, Kadur District:—

"Napier grass seems to be of great advantage to our cattle. Only those who live in the *malnads* know the reality about the scarcity of fodder here. The *maidan* people imagine that on account of the assured rainfall the *malnads* have no fodder problem whatsoever. Here there is, of course, a heavy rainfall in the month of July. But on account of these torrents grass on the hills rots away root and all. It must again root and spring up in August and September when rains are on the decrease, practically these later rains are of little use, specially on the hillside where all the rain-water flows out on the surface without allowing the moisture to accumulate in the soil. The little growth of grass there, is eaten away by the cattle and trampled under their feet.

"I have about 100 head of cattle. My usual way of supplying them with fodder has been to buy paddy straw in the harvest season and preserving it for the rest of the year. In spite of this arrangement I must say that 8–10 of my cattle were dying away each year for want of fodder.

"Last June I got a sample of Napier grass seeds from the Department and without much hopes about it I raised a small nursery. I transplanted the seedlings of one and a half months age. In about three months the grass made a growth of 5 to 6 feet. I fed a cutting to the cattle which took to it without hesitation. After taking a cutting of the grass, the land was hoed and a vigorous crop is growing out of the stubbles.

"With the present indications, I can say that this grass can certainly solve our fodder problem. By increasing this resource, I believe we can build up a cattle industry equal to that of the *maidan* country."

Mr. V. Venkatappa, Thittamaranahally, Channapatna Taluk:—

"The seedlings of Napier grass supplied to me by the Department were transplanted in my garden. As the plot was not level, it could not be ploughed; it was dug by a pickaxe and seedlings were transplanted in pits. There was no rain at the time of transplanting and the seedlings consequently put up a wilted appearance for a long time. The dry stalks recovered after rains came and the crop grew to a height of 6 feet. I am allowing the stand to seed. I am sure this Napier grass grows well and supplies good fodder for cattle."

Mr. Jayarama Prasad, Closepet, Bangalore District:—

"Napier grass grown in half an acre of my lands has come up to 5 feet. My cattle are eating it with relish and I feel, the more tender the grass the more tasteful it will be to them. The raiyats would do well to cultivate this on a large scale."

Mr. Venkatasamappa, Santhehally, Malur Taluk, Kolar District:—

"I have allotted a plot of my lands to Napier grass. It has grown 5 feet high. It is a good fodder for cattle. By growing it we can have a supply of green feed throughout the year."

Mr. Appajappa, Addagal Village, Royalpad Hobli, Srinivaspur Taluk, Kolar District:—

"I planted the Napier grass given by the Department on a gunta of land. It was hand-watered when rain failed. After the rains the plants made a speedy growth rising up to 6 feet. Each hill has 20 to 30 tillers. This has attracted the attention of my neighbours."

AGRICULTURE IN MYSORE

Mention must be made of the results accruing to Mysore Agriculture by the work carried on in the Palace Estates and Gardens Department, particularly in His Highness the Maharaja's Dairy Farm at Rayankere, and the extensive orchards and gardens of His Highness the Maharaja in Bangalore and Mysore. The Rayankere Dairy Farm has been laid out and equipped with buildings and machinery on very efficient lines; fodder crops are raised on a large scale using large-scale power machinery for the various operations, and silage and hay are made on a commensurate scale. The Dairy herd consists of Scindi cows which are being crossed with Holstein bulls. Half-breds of outstanding superiority over the Scindi mothers and vastly superior to the local breeds are being raised to stock the Farm. The evolving of a suitable dairy animal for Mysore which alone can lead to a dairy industry of any importance in the State is the work that is being attempted on the Farm. The Farm and its dairy herd have aroused a great deal of interest among the prominent agriculturists of the State. Likewise the gardens and orchards in which many imported varieties of apples, peaches, grapes, guavas, oranges and other fruit plants, ornamental trees and shrubs have been got out and planted on a large scale not only form centres of great agricultural interest but are influencing greatly, though silently, the fruit-growing and horticultural interests of Bangalore. Many a foreign introduction of fruit and vegetable in Bangalore can be traced to these orchards, and the term "Rajamahal" applied to some of these varieties of fruits and vegetables in the City, is a synonym for choiceness of quality.

—Extracted from "Agriculture in Mysore"

SELECTIONS

Coconut

I. Seed Selection

Seed selection on coconuts can be carried out by any intelligent planter who is willing to take pains. It consists of (*a*) Selection of Mother Palms, (*b*) Selection of Seed Nuts. The selection of mother palms is the more important of the two.

(*a*) *Selection of Mother Palms.*—

A mother palm should be selected according to the following standards:—

(i) The trunk should be straight and stout with leaf-scars situated close to each other. Avoid very tall and curved trunks.

(ii) The fronds should be short and well dispersed on the crown.

(iii) The bunch stalks should be short and should not show any tendency to droop.

(iv) The inflorescences should carry a fair number of female flowers, or button nuts—up to 100. Avoid palms with inflorescences that are overstocked with female flowers. They are not thrifty.

(v) The crown should carry a large number of fronds and, consequently, a large number of inflorescences. Avoid crowns that look empty on one side, even though the inflorescences that are present on the other side appear to set many nuts.

(vi) It need hardly be said that inflorescences should be well stocked with nuts. But it might be mentioned that inflorescences in all stages should be noticeable on the palm, carrying their full complements of developing nuts. Very often one is deceived by heavy lower bunches.

(vii) The size of nut is not important, provided large numbers are present. A medium-sized nut is produced in the best numbers. Palms with extra-large nuts should be avoided.

(viii) The weight of the husked nuts should be high, since on this depends the copra-producing power of the palm. The number of nuts and the weight of the husked nuts provide the best standards of selection.

(ix) Do not select palms growing in favourable situations, such as near cattle-sheds and human dwellings, because they will be better than palms growing in the open field in competition with their neighbours merely by reason of their favourable surroundings. Palms that bear well in a normal or even unfavourable environment should be selected.

Once a mother palm has been selected, it is necessary to study its capacity for yield. In order to do this, yield records must be kept for at least three years, during which time it will be possible to test its performance. The number of nuts and the weight of husked nuts of individual palms should be recorded at every pick in a note book ruled out in the following manner:—

Date of pick ....

Field No.	Palm No.	No. of nuts	Weight of husked nuts	Calculated weight of copra

The weight of copra is approximately equal to 32 per cent. of the weight of the husked nuts. From the last column it will be possible, at the end of each year, to get a fair estimate of the amount of copra which any particular palm would have produced.

It should be borne in mind that, under fair treatment, a good palm will always remain a good palm and a bad palm will be equally constant in remaining bad.

At the end of three years all selections that have not produced, on an average, 100 nuts and 175 lb. of husked nuts per annum should be rejected. *Wherever possible there should be at least one proved mother palm for every five acres on an estate.* This would not be possible in the case of small holdings, the owners of which should, therefore, buy the seed-nuts or seedlings they require from large estates.

(*b*) *Selection of Seed-Nuts.*—

Seed selection does not end with the selection of mother palms. The nuts from these palms should also be selected according to the following rules:—

(i) Only dead ripe nuts should be used for seed.

(ii) First bunch nuts are better than second bunch nuts. But if two bunches must be cut, make sure that the husks of the second bunch nuts have turned brown. Do not use third bunch nuts for seed.

If you are interested in the performance of the daughter palms in relation to the mother palms, as you should be, keep the nuts from the different palms and bunches separate and number each nut according to its mother palm number and bunch number; and when planting the nuts in the nursery, be careful that the nuts do not get mixed. Pegs should be used to mark the palm and bunch numbers.

When the seedlings are put in the field, they should carry individual numbers stamped on zinc tabs. The tabs could be tied on with wire to the seedlings, when they are being transplanted, but later they should be fixed to wooden pegs driven into the ground.

The extra work involved in carrying out the suggestions made in the last paragraph will be well worth while, because in a few years, when the daughter palms come into bearing, you will be able to compare their performance with that of the mother palms.

II. Nursery Management and Selection of Seedlings

1. Coconuts should not, as a rule, be planted out directly in the field since:—

(*a*) Seed nuts do not all germinate at the same time, and late germinations, which would be rejected in the nursery, would be allowed to remain in the field. It is believed that seed nuts which germinate slowly give rise to palms which are equally slow in coming to maturity.

(*b*) The selection of seedlings for characters other than early germination would be prevented.

(*c*) Watering, which is necessary during the early stages of growth and which can be carried out easily in a nursery, would be much more difficult and expensive in the field.

(*d*) It will be extremely difficult in the open field to keep a check on the various pests and diseases that attack coconut seedlings during their early life, whereas in a nursery this would be a fairly easy matter.

2. *Location.*—Nurseries should be on sandy or light loamy soil, free from water-logging, but close to a source of water like a well or stream, away from heavy shade, and, if possible close to the area which is to be planted up.

3. *Seed Beds.*—The nursery-beds should be long and narrow in order to facilitate watering when necessary, and should be raised 8 to 10 inches above the general ground level. Beds should be separated by shallow drains, which join up to form a leader drain for carrying away excess water during rains.

It is hardly necessary to add that the soil in the beds should be free from stones, coconut roots and weeds. The presence of coconut roots and other decaying organic matter in the soil encourages termites which are quick to attack germinating coconuts and coconut seedlings.

In permanent nurseries, the edges of the beds should be turfed; otherwise, they will get damaged during rains and fall in, blocking up the drains as a result.

After the soil in the beds has been levelled, it should be compacted with an ordinary wooden compactor or a light garden-roller.

4. *Spacing.*—The spacing of the nuts in the beds will depend on the length of time the seedlings are intended to be kept in the nurseries after they have germinated. The longer the period, the wider should be the spacing. As a general rule, it is unwise to keep seedlings too long in the nurseries, because once the roots have passed out of the husk and penetrated into the soil, it is not possible to take the seedlings out for transplantation without subjecting them to a more or less serious shock due to root damage. The ideal to aim at is to remove the seedlings before the roots have entered the soil. This is not always possible in practice, especially if seedling selection in the nursery is intended, when the seedlings have to remain in the nursery until they have developed at least two foliage leaves.

If it is desired to transplant the earliest sprouted nuts before any roots have passed out of the husk into the soil, that is, when the sprout is about an inch long, seed nuts could be put down very close to each other, less than six inches apart. There will be no competition for food, moisture or light at this stage and the spacing distance will, therefore, be of little account. When transplanting at this stage, it must be borne in mind that only those nuts should be taken that have germinated within three months of the date of planting in the nursery.

If one intends to transplant when the sprout is 4 to 6 inches long or at the 2nd-leaf stage, seedlings should be spaced 9 to 12 inches from each other.

In laying down a nursery, always try to make a neat job of it. Let the rows be straight and the spacing regular. It is much easier, quicker and safer for the seedlings, to be able to walk up and down a straight row when one has to water them, or hunt after leaf-eating caterpillars or use a spray against scale insects, than to pick one's way over an irregularly planted seed-bed.

We have found it convenient to cut long straight trenches down the beds, spaced 9 inches apart and about 6 inches deep, in which the nuts are placed at the correct distances and covered over with soil.

5. *Position of Nuts.*—Nuts should be planted flat or on the side and not upright. Our experiments have indicated that the seedlings that develop from nuts planted upright suffer more from drought and are less robust than those that develop from nuts planted flat.

After the nuts have been positioned, they should be covered over with soil and not left exposed. The number of nuts planted in the nursery should be at least 50 per cent., or if possible 75 per cent. more than the required number of seedlings. We ourselves reject about 50 out of every 100 seedlings in our nurseries at Bandirippuwa Estate.

6. *Germination and Growth Records.*—Seedlings for transplantation should be selected in relation to the following characters:—

(*a*) Early germination.

(*b*) Rapid growth.

(*c*) Sturdiness and freedom from what is known as "legginess".

The good nurseryman will study each seedling separately. For this purpose, it is necessary to number nuts in relation to the parent palms, the numbers being painted on the nut with tar. For instance, if the nut is the 3rd nut of the 1st bunch of the 52nd palm of the 6th block on the estate, the number on the nut should be VI-52-1-3. If it is the 7th nut of the 2nd bunch of the 39th palm on the 3rd block on the estate, the number should be painted, III-39-2-7, and so on.

A note book should be ruled out as follows and the data regarding the nuts and subsequent seedlings should be entered against each individual number. The suitability or unsuitability of the seedlings for transplantation should be stated in the last column.

NURSERY RECORD

Date of Planting in Nursery .....

Block No.	Palm and bunch No.	Nut No.	Date of germination	No. of days taken for germination	General remarks on seedlings

Since the number on the nuts will not be visible once they have been put down in the nursery, it is a good plan to have pegs to indicate the nuts from each palm. The number of the palm and the number of nuts from each bunch should be painted on the peg, together with the Block number, as follows:—

VI—37 1—7 2—14	which means	Block VI, Palm 37 1st Bunch 7 nuts 2nd Bunch 14 nuts

Coconuts germinate in three to four months, and develop two or three leaves about two months after germination. As a rule, the sprout is developed and appears through the husk some time before the roots pass into the soil. The first roots emerge from the husk when the sprout is a few inches long; and when the first two or three green leaves are developed, not many roots are found to have entered the soil.

7. *Seedling Selection.*—Seedlings are transplanted at one of three stages, *viz.*:—

(*a*) As soon as the tip of the sprout appears through the husk or when the sprout is about an inch long.

(*b*) When the sprout is 4–6 inches long, but before any green leaves have developed or any roots have entered the soil.

(*c*) When the first two or three green leaves have developed.

At the first stage, the sprouted nut could be removed to the field without doing any damage to the roots, but it is impossible at this stage to say whether the subsequent seedling will be robust or weak, well developed or deformed.

At the second stage too root damage is small and the seedlings have the added advantage of a higher survival value than seedlings at the first stage. But at this stage also, the characters of the fully developed seedling cannot be studied and used as a basis for selection.

It is only at the third stage, that a seedling can be properly studied and reliably selected according to all the standards laid down, *viz.*, earliness of germination, rapidity of growth and sturdiness. Data regarding earliness of germination will be found in the nursery record book, mentioned above, and rapidity of growth and sturdiness could be quite easily gauged by eye or by measurement.

The two expressions "sturdiness" and "legginess" might now be defined.

A sturdy seedling grows up straight, has a stout "stem", and dark-green, broad leaves, with stout midribs.

A leggy seedling is often curved in growth, has a thin weak "stem", and pale-green, narrow leaves, with thin midribs.

Some caution must be exercised in selecting seedlings for height alone, since it sometimes happens that leggy seedlings are taller than sturdy seedlings.

8. *General Care of the Nursery.*—No weeds should be allowed to remain in nurseries, especially during drought. Watering should be done once a day during dry weather. No manuring of nurseries is necessary. A careful lookout must be kept for pests and diseases.

Fortunately, in Ceylon we are not troubled greatly with coconut seedling diseases, except very occasional outbreaks of grey-blight, *Pestalozzia palmarum*. Some damage is done by scale insects, *Aspidiotus destructor,* termites and various species of leaf-eating caterpillars, including the coconut caterpillar, *Nephantis serinopa*, nettle grubs, bagworms and the larvæ of the butterfly *Elymnias fraterna*. Notes on the control of scale insects and termites are given later. Caterpillars on seedlings can be controlled by hand-picking or by spraying with lead arsenate at the rate of 1 oz. of the powder in every 2 gallons of water.

Grey-blight causes yellow or brown oval spots, up to half inch in diameter, which dry up in the centre and become typically grey. Protection against the disease may be obtained by spraying at intervals of about a fortnight with a reliable copper fungicide. Colloidal copper (1 oz. to 1 gallon of water) is a convenient fungicide, since it is easy to prepare and relatively cheap. The addition of soft or yellow soap, at the rate of 1 oz. to 1 gallon of the spray mixture, ensures good spreading of the spray. A sprayer of the "Flit" type is adequate for small plants, but in large nurseries a pneumatic knapsack sprayer is desirable. Spraying should be done in the early mornings or late afternoons and *it is necessary to see that both sides of every leaf are wetted with the spray.*

An attack of scale insects will be observed by the appearance of yellow spots on the leaves accompanied by the presence of the insects themselves on the under-surfaces of the leaves. Precautions must be taken at the very first appearance of the insects and the plants should be sprayed with kerosine emulsion, which is quite easily prepared as follows:—

Common laundry bar soap	..	½ lb.
Soft water	.. ..	1 gallon.
Kerosine	.. ..	2 gallons.

Dissolve the soap in the water by shaving it into hot water over a fire. Remove vessel from fire and add the kerosine, stirring thoroughly. Then churn up the mixture by drawing it up into a garden syringe and forcing it back into the vessel. Keep this up until the mixture becomes creamy and begins to thicken. If it does not thicken fairly soon, it may mean that the water is too hard. Add a little borax or soda to soften the water, but this should be done at the start if the water is known to be hard. The mixing is completed when the creamy mass begins to go hard through the pump. The resulting cream or emulsion is your Stock Solution and for applying to the plants mix 1 part of the Stock with 9 or 10 parts of water.

Termites.—

There are two subterranean groups of termites known to attack coconut palms at various stages of their growth.

(1) The mound-building termites, notably *Cyclotermes redemanni* and *Hypotermes obscuriceps*. These are the so-called scavenging termites which feed on dead and decaying plant tissues. They sometimes invade nurseries or individual seedlings in the field to feed on portions of the husk and may injure the growing roots if these are not healthy; and, in so doing they may possibly hinder the growth of healthy roots.

Mound-building termites come from a main mound-nest which may be some distance away, and they may start new nests around or near the seedlings. Such nests eventually become mounds.

These termites have to maintain a continuous connection with a main or subsidiary nest.

Treatment.—All mound-nests should be treated according to the instructions given below:—

The diameter of the base of the mound to be treated must be obtained first. The mound should then be levelled, and one hole should be drilled in the area previously covered by the mound to every 6 inches diameter measurement, the holes being distributed evenly over the area, and being about 12 inches deep. One ounce of petrol should be injected into each hole.

Thus the area covered by a mound, 18 inches in diameter, would require 3 holes and 3 ounces of petrol, while the area occupied by a large mound, 6 feet in diameter, would require 12 holes and 12 ounces of petrol. The cheapest method of application is to drill the hole with a crowbar and pour in tubing. When funds permit, a Vermorel "Excelsior" Injector can be used with advantage, as the dosage can be automatically regulated and the holes drilled by the instrument itself.

The treatment of individual attacked seedlings is given in (2) below:—

(2) Termites that build no mounds, species of *Coptotermes*. These termites live underground and feed on living, healthy tissues, and are occasionally known to attack coconut palms and seedlings. A small underground nest may be near each individual attacked palm.

Treatment.—For the treatment of individual seedlings attacked by termites mentioned in (1) or by species of *Coptotermes*, a soil fumigant such as paradichlorobenzene (P.D.B.) is recommended.

Apply at the rate of 1 large heaped teaspoonful or about ¼ ounce per seedling, mixed thoroughly with 1 cigarette-tin full, or ½ lb., of fine soil or sand to give an even distribution. Sprinkle the mixture thinly and uniformly in a shallow, circular furrow with a radius of about 6 to 9 inches from the seedling or base of palm and cover over with soil.

The Root-Eating Ant.—

This is a true ant *Dorylus orientalis*, although sometimes mistaken for a termite. *Dorylus* is a small, slender, reddish-brown ant, the 'workers' of which are about one-fifth of an inch long, which eats healthy roots of a great variety of plants and riddles tubers and rhizomes. It is occasionally found damaging coconut seedlings. The

paradichlorobenzene soil treatment described above, can be used with success against this pest.

III. Transplantation

(1) *Holes.*—

In transplantation, the preparation of the seedling holes is of the greatest importance. They should never be smaller than 3′ × 3′ × 3′. The harder or more clayey the soil, the larger should the holes be. On gravelly, cabooky or heavy clay soils, seedling holes are often made as large as 5′ × 5′ × 5′. The more usual sizes are 4′ ×4′ × 4′ deep on hard or clayey soils and 4′ × 4′ × 3′ deep on lighter soils. The "Cruciform Hole," which is a modern fashion, is made by means of two trenches 6′ long × 3′ wide × 3′ deep, bisecting each other at right angles, with the centre pit at the intersection deepened by another foot so that it is 3′ × 3′ × 4′ deep. This type of hole is said to be specially useful on hard soils and clays.

After the holes have been cut, they should be filled up. Only good, sandy to-soil should be used for filling, mixed with wood ashes. Two kerosine tinfuls of wood ashes will be sufficient for each hole.

Seedling holes can be disinfected against termites and root-eating ants with paradichlorobenzene according to the method described on "Nursery Management".

Depth of Planting.—

There is a good deal of uncertainty regarding the depth of as much as three feet, and support this practice by stating that deep-planted seedlings are more resistant to diseases, especially bud-rot, and also that they reach maturity sooner. In Ceylon, the experience seems to be that deep-planting delays maturity and it is more usual to put down seedlings nearer the surface than in India, not deeper than one foot at most and very often within the first six inches.

Planting too near the surface cannot, however, be recommended since seedlings thus planted are not sufficiently well anchored to the soil and show a tendency to lean over during windy weather. They also develop roots above the ground and are said to suffer more during drought than seedlings planted deeper.

It is, therefore, a safe practice to plant seedlings at a depth of one foot, earthing up the trunk as it develops, until the general surface level is reached.

(3) *Time of Transplanting and Planting Distance.*—

Seedlings should be transplanted during the monsoons, when the heaviest rains are over. The planting distance on flat land must never be less than 28 feet between seedlings. On hilly land, closer planting may be practised.

(4) *Attention in the Field.*—

This consists of watering, keeping a ten to twelve-foot circle round each seedling free from live weeds and covered with a mulch of dead weeds, protecting the seedlings from damage by black beetle, termites and from pests and diseases generally.

(*a*) *Watering.*—Transplanted seedlings should be watered daily or at least three times a week during the first period of dry weather after they have been put out on the field. If possible, watering during drought should be carried out for the first three years, or until the seedlings have obtained a good root-hold.

(*b*) *Weeding.*—The importance of weeding round seedlings on the field cannot be over-emphasised. A ten to twelve-foot circle round each seedling should be clean-weeded and the weeds put back on the weeded circle to form a mulch.

(*c*) *Ground Cover.*—It is generally held nowadays that a suitable mixed cover crop like *Centrosema pubescens* and *Calopogonium mucunoides*, will not only keep down weeds, but will also have very beneficial effects on the growth of the seedlings. If a cover crop is grown, care must be taken that it does not creep over the seedlings. The safest method, as with weeds, is to keep a ten to twelve-foot circle free from cover but mulched over with the dead material removed from the circle.

(*d*) *Fencing.*—No live fences or husk bunds should be placed round seedlings, but they should be protected from damage by cattle either by means of individual barbed wire enclosures or barbed wire fencing round whole blocks. Very often cattle constitute the chief pest on young plantations.

(*e*) *Pests.*—Beetle catchers must always be employed on young plantations. They should go round daily, armed with the customary "steel", and spear all beetles that are discovered burrowing into the young palms. The wounds should be dressed with light tar or other antiseptic and stopped with wads of fibre soaked in the antiseptic. No tar or other antiseptic should be poured into the holes made by the beetles as this might damage the growing point or the tender leaves surrounding the growing point. Lightly painting the bases of the leaves and false stem with such antiseptic as Mason's mixture is sometimes recommended as a preventive measure against black beetle and red weevil.

Other pests and diseases have been dealt with, in "Nursery Management and Selection of Seedlings" and the same remedial measures against them should be taken on the field as in nurseries.

(5) *Manuring.—*

No artificial manure is necessary during the first year of the life of the seedling on the field, but after that judicious manuring is of the greatest importance.

—Leaflets Nos. 1, 2 *and* 4 *of the Coconut Research Scheme, Ceylon.*

Science and the Indian Peasant

BY

Sir E. J. Russel, D.Sc., F.R.S.
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The main facts of the agricultural situation in India so far as the peasant is concerned are set out in Table I. From this it appears that the population is increasing more than the area of land sown to crops; and, further there is an increasing tendency to grow more saleable crops and less food crops, *i.e.*, to get money rather than food out of the land.

The total of food and non-food crops exceeds the net area sown because some of the land is sown twice in the year.

Indian Crops

On an average only 84 acres of land are used to produce the food of 100 head of population and in some of the more densely populated provinces only 66 acres, as compared with the 220 acres needed to feed 100 head of population in Great Britain. Here, however, we need so much land because we eat so much meat; a vegetarian diet requires much less land and in consequence the diet in India is very largely vegetarian. Rice is by far the commonest foodstuff; then come the millets; and finally, a long way behind, comes wheat, which is further distinct in being confined to Northern India. The areas for the five-year period 1930–35 were, in million acres:

	Million acres British India*
Rice	80·4
Millets	39·2
Wheat	25·7

* Provisional figures for 1936–37 are; Rice 81·7, Millets 39·0 and Wheat 25·2,

TABLE I

Area of land cultivated, and utilization per head of population, British India

	Area in million acres				
	1915–16 to 1919–20	1920–21 to 1924–25	1925–26 to 1929–30	1930–31 to 1934–35	1936–37 Provisional
Net area sown ..	220·7	222·0	226·4	229·1	231·9
Irrigated area ..	47·4	47·0	47·9	49·9	51·7
Food crops ..	210·6	209·5	208·7	214·7	216·7
Fallow	54·2	51·1	49·6	49·8	48·6

	Area per head of population					
	1903–04 to 1907–08	1908–09 to 1912–13	1913–14 to 1917–18	1918–19 to 1922–23	1923–24 to 1927–28	1928–29 to 1932–33
Net area sown ..	0·883	0·906	0·918	0·879	0·868	0·841
Food crops ..	0·829	0·862	0·873	0·833	0·803	0·785
Food crops, omitting sugar	0·818	0·852	0·862	0·822	0·792	0·774
Non-food crops ..	0·053	0·043	0·045	0·045	0·065	0·057
Population, in millions	237·6	243·8	245·3	246·9	259·2	271·5

The grain crops for human food thus form about 77 per cent. of the total sown area. Fruits and vegetables occupy about 2 per cent. of the area sown, sugar 1.4 per cent. and other miscellaneous foods bring the total up to 82 per cent., while the remaining 18 per cent. includes 4 per cent. fodder crops and 14 per cent. of oil-seeds, fibres and few others. The comparison with English agriculture is very striking: grain crops occupy only about 7 per cent. of the cultivated area in England and Wales; on the other hand, fodder crops for animals, which form only 4 per cent. of the cultivated area in India, constitute some 25 per cent. in England and Wales, to say nothing of all our grassland, which adds another 60 per cent. making a total of 85 per cent. of our cultivated land devoted to the production of animal food.

Is Food Production Adequate?

A remarkable feature of Indian agriculture is that the area under food crops per head of population has been falling ever since the period 1913–18, when it stood at 0.87 acres, a figure to which it had been steadily rising for at least ten years; it was in 1928–33 only 0.78 acres, a figure lower than in any of the five preceding five-year periods. On the other hand, the area under non-food crops, *i.e.*, cash crops and others, has steadily risen as the food area has fallen, and in the 1928–33 period stood at 0.057 acres per head against only 0.045 acres per head during the 1913–18 period. Three possibilities present themselves. Yields of food crops may have risen, so that the total production of food is at least as great as ever; or the money from the cash crops may be used for buying food, thus possibly adding variety to the diet; or the peasant may be getting less food than he was during the 1913–18 period. It is difficult to decide between these possibilities. Agricultural statistics in almost all countries are subject to error, especially statistics for yields. In large parts of India even the acreage figures are uncertain, and figures for yield still more so. I shall not attempt to discuss whether yields have gone up or down, or whether the total human food production per head is better or worse than in 1913–18. The more important question is whether the present food production per head is adequate, and, if not, in what directions it needs improving, and how this can be done.

Nutrition Research Institute

The question of adequacy of diet is one for medical authority and not for an agriculturist. The present Viceroy is deeply concerned with the welfare of the peasant and is encouraging full investigations into this question. A Human Nutrition Research Institute has been set up at Coonoor in the Nilgiris under the very able direction of Dr. W. R. Aykroyd, and he has provisionally suggested as the average daily requirement of a man in India, 2,600 calories, 65 grams of protein (10.4 gm. of nitrogen), 45–60 grams of fat, 20 mg. iron, 0.6 gram calcium and 1 gram of phosphorus. The uncertainty about the average yields per acre make it impossible to estimate accurately the total quantities of food produced in India, but from a number of sample enquiries it is reasonable to think that the total production satisfies both the total calorie and the total nitrogen requirements, though with little margin of safety. Dr. Aykroyd, however, emphasizes the importance of biological value of proteins as well as nitrogen content, and shows that animal proteins are biologically more efficient than vegetable proteins: he suggests that they should form at least one-fifth of the total protein in the diet. Milk, even skim milk, he

points out, is the best for growing children, but eggs, fish and meat are all good sources.

Threefold Problem

These foods are almost certainly consumed in inadequate quantities. More serious is the lack of vitamins, especially of A and B; this is confirmed by the prevalence of the deficiency diseases caused thereby; keratomalacia caused by deficiency of vitamin B, and low hæmoglobin content of the blood due to iron deficiency. The agricultural problem is thus threefold: (1) to increase the total production of foods so as to widen the margin of safety; (2) to increase the production of milk and other animal products so as to improve the biological value of the proteins; (3) to increase the supply of vitamins, of calcium, phosphorus, and other mineral substances. So far we have been dealing only with averages over the whole country. But India is very vast, and it comprises many widely different regions and groups of people, and it would not be easy to ensure that every part and every class should be self-sufficing in the matter of food production. There must always be exchange between one place and another and hence it is important to increase the value of the cash crops so that the peasant may have the necessary money to buy the things he is not himself producing. This then gives the agriculturist his fourth task: to raise the value of the cash crops; which means improving both their quantity and quality.

These tasks may be achieved in two ways: by increasing the area of cultivable land or raising its level of output; and by improving the crops. Both methods are being adopted. There is still a considerable area of land in British India not yet cultivated, but a large part of this could be cultivated only with difficulty:

Utilisation of land area, 1935–36, British India

	Million acres
Net area sown	228·7*
Culturable waste, other than fallow ..	153·1
Area uncultivable	146·0
Forest	89·8

* Not including 51,399,765 of fallow.

The more hopeful method is to improve land already in cultivation so as to increase the yields and to widen the scope of cropping. The most efficient method of doing this is, in general to irrigate it, for of all causes of infertility in India shortage of water is the most widespread and serious.

Irrigation

Irrigation is done in three ways: (1) by wells; (2) from tanks; (3) from dammed-up rivers, by means of canals. Nearly a quarter of the sown area in British India is irrigated, and of this about half is watered by canals and about a quarter by wells:

British India	Million acres	
	1934–35	1936–37
Irrigated by—		
Canals	26	Provisional
Wells	12·5	
Tanks and other methods	12	
Total ..	50·5	
Total area sown ..	227	
Percentage irrigated ..	22	

All these methods of irrigation are ancient, but the old method of irrigation from wells, when the lifting is done by bullocks, leaves perhaps the most abiding memory of Indian village life on one's mind. The monotonous journeying to and fro: the creaking of the windlass, the swishing sound of the water as it is discharged from the bag or bucket; these things one can never forget. The most striking contribution of science to well irrigation has been the development of tube-wells carried out to a notable extent in the Punjab and adjacent regions, where the subsoil carries plenty of water. This method has been well developed by Sir William Stampe and in places is combined with washing and bathing facilities, so that the well really becomes a centre of life for the inhabitants. Tube-well irrigation is largely used for sugarcane and other valuable crops.

Recent Developments

Irrigation from canals has been greatly developed under British rule, and indeed, if the British with India had done nothing else it would deserve to be remembered always for the enormous dams and irrigation systems we have set up in order to ensure the maximum of beneficial use of the water that flows down from the Himalayas and other mountains, and might if left alone, do great harm or at best only run to waste. I need mention only one: the great irrigation system in Sind, in which the waters of the Indus are distributed over a vast area of what would otherwise be of low productivity or even desert, converting it into fruitful land. The opening of the Lloyd Barrage in 1932 had already brought into cultivation some 6,00,000

acres of land by 1935–36, besides adding greatly to the areas under cotton and wheat.

TABLE II

Cropping in Sind before and after the setting of the Lloyd Barrage in 1932

Crop	Acreage in thousands			Production in thousand tons		
	1913–14 to 1917–18	1923–24 to 1927–28	1933–34 to 1935–36	1913–14 to 1917–18	1923–24 to 1927–28	1933–34 to 1935–36
Cotton	264	399	649	..	..	..
Wheat	594	441	1,157	237	93	278
Rice	1,166	1,148	1,097	399	455	403
*Juar**	617	549	466	187	118	103
Bajri†	979	1,064	854	164	150	99
All gram crops, except wheat	3,188	3,276	2,921	814	807	669
Fruit and vegetables	44	46	49‡	..	..	..
Oil-seeds	404	299	194	..	..	..
All crops	4,609	4,554	5,141	..	..	..

* Chiefly in Upper Sind.
† Chiefly in Middle and Lower Sind.
‡ Two years only, 1933–34 to 1934–35.

The production of cotton and of wheat has greatly increased: that of rice shows little change, but the millets and other grain crops have fallen off considerably so that the total production of grain is less than it was. Nevertheless, the cash value of the produce has much increased.

AGRICULTURISTS' DIFFICULTIES

The setting up of an irrigation system is a task for the engineer, but when he has finished and retired with honours the difficulties of the agriculturist begin. First is the question of seepage water. The canals are rarely water-tight; they let the water ooze out and water-log the adjacent soil. Many acres of agricultural land have been ruined in Sind, and whole villages have suffered subsidence. Then there is the question of salt. Sooner or later salt nearly always appears in irrigated regions. It comes up from some lower layer of the soil where perhaps it had done no harm to the crops; it reaches the

surface and spreads, killing every useful plant it touches. Both sets of problems are difficult and require for their study a good deal more fundamental investigation than they are getting. Other problems are more definitely agronomical; such as the choice of suitable systems of cropping and varieties of crops; methods of manuring; optimum quantities of water and times of application.

But all these problems are difficult, and require the services of an exceptionally competent staff. Such men are rare, and they cannot be produced by mere training. Men not up to the necessary high standard may involve the cultivators in serious loss and do irreparable damage to the whole irrigation system. These irrigated regions properly managed are a great triumph for human enterprise, but there lie always within them the seeds of great tragedy.

The Punjab Irrigation Research Institute at Lahore is doing some very good work under Dr. E. McKenzie Taylor.

In regions where irrigation is impossible, but where crops usually suffer drought, it is frequently possible to adopt special devices for making the most of the water that actually reaches the soil. These include the setting up of bunds, and various cultivation devices grouped under the general name 'Dry Farming Methods'; they have been effectively studied in the Bombay-Deccan.

The improvement of crop yields is effected by finding or breeding better varieties than those in common use, and by raising the level of production by better cultivation, more efficient manuring and management, and by better control of pests and diseases. I shall deal with the chief crops important to the peasant.

Most Important Crops

Rice.—Rice is by far the most important crop in British India occupying 84 million acres out of the 215 million acres devoted to food crops. An enormous number of varieties occur in India of widely different types, some of them of great scientific interest, and much work has been done in classifying them in selecting the more promising, and in breeding new sorts. The foundations were laid by G. P. Hector in Bengal and F. R. Parnell in Madras, and much subsequent work has been done by K. Ramiah at Coimbatore, and others. Rice is peculiar among grain crops in that many of its varieties are semi-aquatic and others entirely aquatic in their habit of growth, and this of course, means that their manuring and cultivation are on quite unusual lines. The scientific problems associated with the growth of rice are thus of exceptional interest. They are also, however, very difficult, and the experiments have often to be carried out under very trying conditions; they involve paddling about during the hottest part of the day in gum boots in a muddy swamp infested with leeches

and snakes, and made more disagreeable by mosquitoes and other insects. In spite of all this a great number of investigations have been made, and a considerable acreage—3·6 million acres out of 84.3 million or 4.3 per cent. of the total area—is now sown with improved varieties. It cannot be confidently asserted, however, that there is any increase in the amount of rice produced; apparently, the acreage has somewhat decreased, and it is sometimes stated, though on no good evidence, that the yields have actually decreased. This does not mean that the scientific work has been useless; simply that it has not yet come to full fruition.

Millets.—The millets come next in importance to rice; many different sorts are grown, the commonest being *juar* (*Andropogon Sorghum*), *bajri* (*Pennisetum typhodeum*), and *ragi* (*Eleusine coracana*): the acreages are:—

	Million acres, 1936–37		
	British India	Indian States	All India
Juar ..	23·1	13·0	36·1
Bajri ..	11·1	4·0	15·1
Ragi ..	3·7	2·8	6·5
TOTAL ..	37·9	19·8	57·7

The millets differ fundamentally from rice in that they are dry land crops and may receive no water except what the rain brings, though, of course, if irrigation water is available it is given. They are sown just about the time the monsoon breaks so that they may obtain all the rain that comes, and they are indeed the chief crops in the non-irrigated and dry-farmed regions. This great contrast with rice explains why the two crops so often appear as complementary; where the acreage of one is high the acreage of the other is low, and *vice versa.*

Until recent years there has been little scientific work done on the millets in India, but investigations have been started at Coimbatore, at Indore and also in connexion with various dry-farming schemes. A few improved varieties have been found, but they have not spread, and the peasant has as yet derived but little benefit from the labours of the scientist.

Wheat.—In regard to wheat, however, the story is quite different. Here, however, the problem was different. When the British scientific workers started investigations on wheat their purpose was to select varieties suitable for the British market, so that the export

trade might be improved. The Howards were the founders of the modern work on wheat in India; David Milne studied the Punjab wheats, and other workers have followed; their efforts have been so successful that some 20 per cent. of the wheat area in 1934–35 was sown with improved varieties. The word 'improved', however, needs some explanation. Quality in crops is an ambiguous term: the layman often thinks it means high nutritive value; actually it generally means commercial desirability, which in the case of wheat is suitably for the English miller who will use it for blending and is not concerned with its nutritive value. In so far as Indian wheat is intended for the British market this is obviously the standard to take. But the consumption of wheat in India is increasing, and it is estimated that some 45 per cent. of the total Indian production is now consumed in the villages. In view of this changing market, obviously Indian requirements should be studied and these are probably entirely different from British requirements; in India the wheat is not made into loaves, but into *chapattis*, something entirely different. It might be urged that India cannot spare grain for export, but against this is the cogent argument that an export trade in good years affords a sure guarantee against famine in bad years. I shall not argue this question of policy, but only point out the desirability of discovering the properties needed for the making of good *chapattis*, and if necessary, producing and cultivating varieties of wheats possessing them.

Special reference should be made to the work on rust now being done in Northern India by K. C. Mehta.

Barley.—This crop, like wheat, is of importance only in parts of Northern India; it occupies only about 6½ million acres in all British India, most of which (4.17 million acres) comes in the United Provinces: of the rest 1.2 million acres is grown in Bihar and Orissa and 0.6 million acres in the Punjab. The barleys are of the 6-rowed type, and as these are used by English brewers efforts have been made to breed barleys suitable for the English market. These have met with considerable success, and the experiment stations have sent over to this country samples which have been favourably reported on by the Expert Committee of the Institute of Brewing. As in the case of wheat, however, large-scale industry has not kept pace with the plant breeder or selector and the commercial lots coming to this country fall far below the quality of the plant-breeders' samples.

Cash Crops.—We now turn to the cash crops. The two most important are cotton and sugar, but I shall confine myself to sugar partly for considerations of time, but chiefly because I studied it in more detail during my Indian journey. India is the second largest consumer of sugar in the world; the first is the United States, which in 1934–35 consumed 5.87 million metric tons; the third is the United

Kingdom with a consumption of 2.28 million metric tons; while India comes in between with a consumption of 3.35 million metric tons. An assured and abundant supply of sugar is essential to India's happiness. Some 80 per cent. of the sugar is eaten as *gur,* or jaggery as it is called in the south; this is the yellowish or brown mass produced on evaporating the juice of the sugarcane in an open pan; there is a certain amount of clarification. *Gur* has always been made in India. But about a million tons of white sugar a year are consumed also, and much of this till recently was imported. Now, however, it is practically all made in India. The production of sugar is shown in Table III.

TABLE III

Sugarcane Crop

Acreage and production†

Provinces and States	Area (in thousand acres)		Yield (in thousand tons) of raw sugar (*gur*)	
	1935–36	Average of five years 1930–31 to 1934–35	1935–36	Average of five years 1930–31 to 1934–35
United Provinces (including Rampur State)	2,249	1,597	3,336	2,063
Punjab	473	446	358	336
Bihar	465	313	668	371
Bengal	325	224	560	330
Madras	131	114	360	322
Bombay (including Sind and Indian States)	121	99	313	256
North-West Frontier Province	58	49	63	55
Mysore	50	38	53	36
Hyderabad	59	38	99	60
TOTAL ..	3,931	2,918	5,810	3,829

† From Department of Commercial Intelligence and Statistics in *Indian Trade Journal Supplement,* May 1936.

The figures were still higher in 1936–37 though they appear to have fallen in 1938–39. The establishment of sugar production in India on so firm a basis is the direct result of the breeding experiments started by Dr. Barber, and especially his happy crossing of *Saccharum*

spontaneum with the sugarcane, which yielded new varieties of great vigour and power of growth. This work has been ably continued by Rao Bahadur Venkataraman, and in consequence India is now provided with a number of varieties suited to the various regions. These new sorts have almost ousted the old ones; some 80 per cent. of the area planted with sugarcane is under new varieties. Notable advances were made in the cultivation methods by G. Clarke at Shahajahanpur (1912–30). Much of the success of the sugar industry is due to the improvements effected by technical chemists and engineers in the factories,* under the stimulating influence of Sir Harcourt Butler, and there is still scope for further efforts.

Fruit and Vegetables.—I have spoken earlier on the shortage of vitamins in the ordinary diet of the peasant. An obvious remedy is an increase in the consumption of fruit and vegetables. A wide range of fruits can be grown in India; ordinary European fruits in the hills of the north and tropical fruits in the plains. Much work is now being done on the subject, though it is not clear that the area under these crops has yet increased. No area figures are available, but it is estimated that about 2½ million acres are devoted to fruit.

Milk and Livestock.—There is a fair consumption of milk in parts of the Punjab and some of the hill districts but in general the consumption is far too small. It is stated† that the average daily ration of milk in the Punjab is 10 oz., while in Bengal, Madras and the Central Provinces it is only 2 oz. or less. This is bound up with the general livestock problem which in India is very difficult and is complicated by the fact that the Hindus regard the cow as a sacred animal and refuse to kill ineffective animals; food has to be spread over a large animal population, many of which give no adequate return.

Dr. Norman Wright recently reported on this milk question so that it is unnecessary for me to discuss it. Scientific work on the subject is being done, subject to the limitations inherent in the problem. One hopeful line is the improvement of the grazing lands in the forest areas as this deals also with another difficult problem, soil erosion, which, however, lies outside the scope of this lecture.

The Effect of the Improvement

Table IV shows the approximate areas sown with improved varieties. The greatest success has been with sugarcane. But wheat

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* Out of a total of 150 factories no fewer than 126 are situated in the subtropical Gangetic plan of North India.

† General Sir John Megaw, in *Social Service in India*, Sir Edward Blunt, Stationery Office, 1938. This book gives an excellent account of Indian problems, and the way in which they are being attacked.

and rice present a considerable achievement in view of the large acreage involved. It must be remembered that there is no honest seed trade in India which can take over the multiplication and distribution of improved varieties of crops, as is done in Great Britain; all this in India must be done by the overworked officials of the Department.

Time does not permit any description of the advances made by scientific workers in knowledge of the fertilizer requirements of crops, or in methods of cultivation, but these have been considerable. Under the Imperial Council of Agricultural Research further great improvements may confidently be expected.

The full result of the scientific work, however, is not shown in this table, but rather in the high levels of yield and quality obtained at the experiment stations. These are not infrequently double or treble the yields obtained by the peasants. The great problem in Indian agriculture is not so much to acquire new knowledge as to bridge this gap between peasant practice and experiment station achievements.

The Causes of Frustration

There are several reasons for this wide gap, but in my view the two most potent are the poverty of the peasants and the lack of an educated agricultural middle-class.

There are, of course, many zamindars and other landlords and farmers who take a direct interest in their land and their people, and who do much to raise the standard of farming. But they are exceptional, and broadly speaking there is a serious lack of leaders in the agricultural community to take over agricultural improvements from the experiment stations and put them into practical form, modified to suit the local conditions. The educational system has not produced this type of man and although there are agricultural colleges the students only rarely taking up farming.

Rural Areas Improved

In their defence it must be said that the acquisition of agricultural land by an outsider is often difficult, and the villages are singularly unattractive places in which to live. Poverty, dirt and diseases are still rife in spite of years of effort to get rid of them. But at last the efforts are beginning to tell; a widespread movement for improving village life is being fostered, not only by the British but also by the best of the Indians themselves, and is spreading over the country. Already many of the villages have been cleaned up; wells have been walled in; the streets freed from garbage and other refuse which is now used to make compost heaps; mango trees have been planted and the roads improved. We can only hope that, when the villages become fit for educated people to live in, they will go and live there.

TABLE IV

Approximate proportion of area sown with improved seed

Crop	Million acres		Percentage
	Total acreage	Acreage under improved seed	
Sugarcane ..	4·00	3·27	81·7
Jute ..	2·18	1·3	59·6
Wheat ..	33·61	8·5	25·3
Cotton ..	26·00	5·04	19·20
Rice ..	83·43	4·58	5·5
Groundnuts ..	5·86	0·22	3·40
Millets ..	38·69*	0·34†	Not calculated, as figures are incomplete
Gram ..	16·90	0·33†	

* Including *juar, bajra* and *ragi* only.
† Not separately reported by some provinces.

Already a beginning has been made: In the Punjab, for example, steps have been taken to settle graduates on the land and some 8,900 acres of land have been colonized by 162 educated young men, of whom 89 comprise the entire cultivating population of four villages and the remainder are scattered in pairs over villages where it is hoped they may exert a profound influence for good. But in the meantime many of the agriculturists are too poor to be able to undertake any but the simplest changes. Many of the peasants are very shrewd, with a considerable knowledge of their soils and crops. But they are hampered by ineffective cattle and implements, by lack of manures, and by lack of money. Special methods are needed for passing the knowledge gained at the experiment stations over to the peasant and showing him how to use it in his daily work so as to reduce the poverty which at present so hampers progress. What India needs now is not so much new scientific knowledge about general agriculture, but fuller use of existing knowledge, and the working out of methods to reduce the present wide gap between the ordinary cultivator and the experimental farm. Fortunately all parties seem to have agreed on the vital necessity of improving the lot of the peasant, and we can look forward with confidence to the results of the labours of the many beneficient agencies working to this end.—*Journal of the Royal Society of Arts.* —*Indian Farming,* Vol. I, No. 4.

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